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ABSTRACT

This document is the sixth annual, legislatively mandated report on the human nutrition research and education activities of the United States Department of Agriculture for fiscal year 1992 in which directions and highlights are emphasized. The report contains six sections. Section 1 is an introduction. Section 2 covers human nutrition research activities. This section notes new research projects, research highlights and other research findings during 1992. Overall human nutrition research and education activities continued to be linked with the nutritive value of foods, human nutritional needs, the kinds and amounts of foods that Americans consume relative to their needs, and the strategies for improving diets and the food supply. Section 3 describes nutrition education and information programs which include the Cooperative Extension Service and the Food and Nutrition Service, a federal funding source for nutrition education that serves a variety of programs. Section 4 contains information on funding levels for 1986-93. The total amount of financial support from the Department increased from $60.7 million in 1986 to $76.1 million in 1992, an increase of 25 percent. Section 5 describes coordination and advisory mechanisms. Section 6 summarizes the potential benefits of improved diets and nutritional status. (JB)

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United States
Department of
Agriculture

1992 Report on USDA Human Nutrition Research and Education Activities

A Report to Congress

Covering the Period
January-December 1992

U.S. DEPARTMENT OF EDUCATION
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Abbreviations

AMS	Agricultural Marketing Service (USDA)
ARS	Agricultural Research Service (USDA)
ASFSA	American School Food Service Association
CDC	Centers for Disease Control (DHHS)
CES	Cooperative Extension Service
CSRS	Cooperative State Research Service (USDA)
DHHS	Department of Health and Human Services
DOC	Department of Commerce
EPA	Environmental Protection Agency
ERS	Economic Research Service (USDA)
ES	Extension Service (USDA)
FDA	Food and Drug Administration (DHHS)
FNIC	Food and Nutrition Information Center
FNS	Food and Nutrition Service (USDA)
FSIS	Food Safety and Inspection Service (USDA)
HNIS	Human Nutrition Information Service (USDA)
NASS	National Agricultural Statistics Service (USDA)
NCHS	National Center for Health Statistics (DHHS/CDC)
NIH	National Institutes of Health (DHHS)
NFSMI	National Food Service Management Institute
NLEA	Nutrition Labeling and Education Act
NMFS	National Marine Fisheries Service (DOC)
NNMRRP	National Nutrition Monitoring and Related Research Program
OCA	Office of the Consumer Advisor (USDA)
OPA	Office of Public Affairs (USDA)
USDA	United States Department of Agriculture
WIC	Women, Infants, and Children

Executive Summary

Introduction

In accordance with the provisions of section 1452(b) of the National Agricultural Research, Extension, and Teaching Policy Act Amendments of 1985 (7 U.S.C. 3173 note), this report on the human nutrition research and education activities of the U.S. Department of Agriculture for fiscal year (FY) 1992 is hereby submitted. This is the sixth annual report in which directions and highlights are emphasized without restating the Department's detailed plan outlined in the report submitted in 1986.

Contents of Report

New human nutrition research projects initiated, research highlights, and other research findings during FY 1992 for USDA Agencies are presented by research areas as follows:

- Normal Requirements for Nutrients
- Role of Nutrition in Promoting Health and Preventing Diet-Related Disorders
- Food Composition and Nutrient Bioavailability
- Food and Nutrition Monitoring Research
- Government Policies and Socioeconomic Factors
- Food and Nutrition Information and Education Research
- Food Marketing and Demand

The numbers of USDA research projects included in the Human Nutrition Research Information Management System in 1992 are shown by Federal nutrition code category. The food and nutrition information and education programs within USDA also are summarized by new initiatives and ongoing programs to meet their clients' needs.

Human nutrition research and education activities in USDA continued to be linked with the nutritive value of foods, human nutritional needs, the kinds and amounts of foods that Americans consume relative to their needs, and strategies for improving diets and the food supply. The major role of USDA is to help individual consumers understand the relationship of food and its nutrients to the maintenance of health and the prevention of diet-related disorders during the different stages of life. Because consumers' demands drive the marketplace, the importance of sound, research-based nutrition education programs for consumers, as well as for food producers and processors, is obvious.

Funding Levels

The actual or estimated expenditures for human nutrition research, monitoring, and education by several USDA Agencies for fiscal years 1986 through 1993 are given (tables 2-6). The total amount of human nutrition research and monitoring support by USDA increased from $60.7 million in FY 1986 to 76.1 million in FY 1992, an increase of 25 percent. During the same period, USDA support for human nutrition education increased 61 percent, from $132.1 to $212.4 million. Most of the funds for education activities were distributed to State health and nutrition agencies. The total USDA support for human nutrition research, monitoring, and education in FY 1992 was $288.5 million and is estimated to be $310.2 million in FY 1993.

Coordination

Continued progress was made during FY 1992 in achieving coordination within USDA, with other Departments, and with the private sector and international organizations, thus helping to provide the best services possible within available resources. A description of coordinating mechanisms in place during FY 1992 and the specific recommendations made by outside advisory groups are also included in the report.

Benefits

The potential benefits of improved diets and nutritional status are better health and a longer, more active, and more satisfying life. The development of new information to fill knowledge gaps, as well as the application of existing knowledge, is essential to the prevention of diet-related health problems and to increased performance and satisfaction.

1992 Report on USDA Human Nutrition Research and Education Activities: A Report To Congress

I. Introduction

A. Charge

In accordance with the provisions of section 1452(a) of the National Agricultural Research, Extension, and Teaching Policy Act Amendments of 1985 (7 U.S.C. 3173 note), a U.S. Department of Agriculture (USDA) comprehensive plan for implementing a national food and human nutrition research and education program was submitted to Congress in December 1986. Section 1452(b) of this Act requires the Secretary annually thereafter to submit a report on the human nutrition research activities conducted by USDA. Such reports, prepared under the auspices of USDA's Human Nutrition Coordinating Committee under the Human Nutrition Policy Committee of the Secretary's Policy Coordination Council, have been submitted for 1987, 1988, 1989, 1990, and 1991. This report covers the Department's activities in human nutrition research and education for 1992. As before, emphasis is given to new directions and accomplishments during the year. The 1986 report gives the detailed program plan components.

B. Legislative

1. Nutrition Labeling

Public Law 101-535, the Nutrition Labeling and Education Act (NLEA), was passed by Congress and signed into law by the President in 1990. This law amends the Federal Food, Drug, and Cosmetic Act, not the Federal Meat Inspection Act or the Poultry Products Inspection Act. Therefore, only the Food and Drug Administration is required by law to enforce it. USDA is affected indirectly by the NLEA through harmonization efforts.

- Nutrition Labeling Regulation

The Department of Agriculture's Food Safety and Inspection Service (FSIS) developed and published a final regulation on January 6, 1993 for the nutrition labeling of meat and poultry products. This regulation is the result of several nutrition labeling endeavors. (1) The National Academy of Sciences issued a report recommending FSIS and FDA mandate nutrition labeling, (2) the NLEA requires mandatory nutrition labeling for most FDA-regulated packaged food products, (3) FSIS and FDA developed and issued proposed regulations requiring nutrition labeling, and (4) there were extensive public comment and public hearings regarding this issue.

Harmonization has been a major goal for both FSIS and FDA. Both agencies have worked closely together since 1989 to develop and publish similar regulations for the nutrition labeling of food products. These regulations will require the same label format, listing of nutrient values, similar serving sizes for like products, and similar definitions for almost all nutrient content claims. FSIS's final regulations parallel FDA's, with a few exceptions due to the differences in the types of foods regulated by each agency.

The implementation date for FSIS's regulations is July 6, 1994. Major provisions include the definition of nutrient content claims, development of uniform serving sizes which include product categories and reference amounts, requirements for which nutrients are mandatory and which nutrients are voluntary, and the development of Daily Reference Values (DRV) for use in planning a healthy diet.

Nutrient content claims that will be used most frequently for meat and poultry products include "lean," "extra-lean," " percent lean," and "_ percent fat-free." Products using the term "lean" must provide less than 10 grams of fat, less than 4 grams of saturated fat, and less than 95 milligrams of cholesterol. Products using the term "extra-lean" must provide less than 5 grams of fat, less than 2 grams of saturated fat, and less than 95 milligrams of cholesterol. Products may make "_ percent lean" and "_ percent fat-free" claims if they meet the definition of "low fat."

In addition to preparing the final regulation on nutrition labeling, in 1993 FSIS has prepared a proposed regulation to permit the use of and define terms such as "healthy" and "healthful." The proposed definition will allow meat and poultry products that meet the definition of lean and contain less than 480 milligrams of sodium to use these terms. Also in 1993 FSIS will publish proposed regulations for the use of health messages on meat and poultry products. Finally, proposed regulations for products with standards of identity that are affected by the nutrition labeling regulations will be published.

- Costs Associated with Nutrition Labeling

The Economic Research Service (ERS) and FSIS jointly estimated the costs associated with USDA regulations for mandatory nutrition labeling on meat and poultry products for retail sale. Their analysis is reported in *Final Regulatory Impact Analysis of Regulations for Nutrition Labeling of Meat and Poultry Products*, FSIS, December 1992.

A 20-year period was selected as the timeframe for estimation, because many benefits ascribed to the new nutrition labeling regulations--such as reduced mortality from cancer and coronary heart disease--would not begin to accrue for some years. Following on a study conducted by the Research Triangle Institute, costs were visualized as: (1) start-up costs (such as costs related to administrative decisions, initial analytical testing in the laboratory, printing of new labels, and loss of current label inventory) and (2) recurring costs (the costs of repeating analytical tests over the years).

Large cost estimates--primarily associated with analytical testing of nutrients in foods--and public comments led USDA to reconsider some initial decisions, and make two changes from its proposed regulations: (1) Food manufacturers may use recipe analysis and food composition data bases to support the information on the nutrition label, and (2) small businesses are exempt from mandatory nutrition labeling.

Industry can save money by using established food composition data bases--for example, the Human Nutrition Information Service's (HNIS) Agriculture Handbook No. 8 Series Composition of Foods: Raw, Processed, Prepared--to support the information on the nutrition label. Laboratory testing of nutrients in foods is expensive. Allowing manufacturers to use recipe analysis and data bases was estimated to reduce industry costs by $140 million to $229 million over 20 years, assuming that 30 percent of the products would carry nutrition labels based on such information, and depending on whether the remaining 70 percent of products would undergo analytical retesting every 2 years or every 5 years.

Exempting small businesses from mandatory nutrition labeling was found to significantly reduce industry costs with little loss in benefits to consumers. The issue was how to minimize the risk that any small business would have to close, while maximizing the proportion of production providing nutrition information. The analysis revealed that most of the health benefits could be achieved if the relatively few products that account for most of total production provided nutrition labeling. On the other hand, most of the compliance costs would be borne by the large number of products that account for a relatively small proportion of total production. Using scanner data and other information, the researchers experimented with different cutoff points for exempting a business from mandatory nutrition labeling. They identified products below 100,000 pounds of annual production by firms with 500 or fewer employees as a cutoff point that would exempt an estimated 97 percent of the products produced by small businesses, while retaining nutrition labeling for approximately 95 percent of all grocery store sales. If the exemption were to be phased in over 3 years, with a cutoff of 250,000 pounds the first year, 175,000 pounds the second year, and finally, 100,000 pounds the third year (and assuming 30 percent of the products would use recipe analysis to obtain the nutrient information for the label), total costs associated with mandatory nutrition labeling were estimated to be reduced by $562 million to $768 million over 20 years.

2. Nutrition Education

Title III of Public Law 101-445--The National Nutrition Monitoring and Related Research Act of 1990--calls upon USDA and the Department of Health and Human Services (DHHS) to jointly publish the Dietary Guidelines for Americans every 5 years and to review and approve all dietary guidance prior to publication. USDA and DHHS are in the process of establishing Memorandums of Understanding to accomplish these goals. As in the past, a Federal Advisory Committee will be established to advise the Secretaries of USDA and DHHS on revisions to the Dietary Guidelines for Americans. These are scheduled to be released in 1995. Dietary guidance materials are reviewed within USDA by a committee representing 10 USDA agencies with a liaison from DHHS. This committee has been reviewing USDA dietary guidance materials since 1986. It now reviews materials from DHHS as well.

3. National Nutrition Monitoring and Related Research Program

Public Law 101-445, the National Nutrition Monitoring and Related Research Act of 1990, requires the Secretaries of USDA and DHHS to establish and implement a comprehensive plan for the coordinated National Nutrition Monitoring and Related Research Program (NNMRRP) with numerous components. The NNMRRP is composed of interconnected Federal and State activities that provide information about: (1) dietary and nutritional status of the United States population; (2) conditions existing in the United States that affect the dietary and nutritional status of individuals; and (3) relationships between diet and health. HNIS, the USDA lead agency for nutrition monitoring, works jointly with DHHS in implementing the Program. The Interagency Board for Nutrition Monitoring and Related Research met four times in 1992 and provides a formal mechanism for promoting the Program's overall goals and activities. Under the direction of the Board, USDA and DHHS developed and have begun implementing the Ten-Year Comprehensive Plan for Nutrition Monitoring and Related Research.

C. Changes in Resources or Infrastructure

1. Special Supplemental Food Program for Women, Infants, and Children (WIC)

a. Cost Containment

Funds generated through cost containment efforts implemented by WIC State agencies continue to be substantial and are having a significant impact on the program. The most popular cost containment initiative has been infant formula rebate systems. Currently, 76 of 85 State agencies operate an infant formula rebate system pursuant to P.L. 100-237. Actual savings from infant formula rebates for FY 1991 were $650 million, and for FY 1992 increased by over $100 million to $755 million. These savings, plus steadily increased appropriations--from FYs 1985 to 1992, WIC has experienced a 73-percent increase--have permitted a substantial increase in participation. In FY 1992, the WIC Program provided benefits to an average of 5.4 million participants per month, an increase of 0.5 million above the FY 1991 participation level. As of December 1992, 5.6 million participants were being served.

b. WIC Farmers' Market Nutrition Program

Public Law 102-314, enacted July 2, 1992, established the WIC Farmers' Market Nutrition Program (FMNP), creating the 14th food assistance program to be administered by the Food and Nutrition Service (FNS). The FMNP provides coupons to WIC participants, or persons on a waiting list to receive WIC services, that enable them to purchase fresh, nutritious, unprepared foods (such as fruits and vegetables) from farmers' markets. It is also intended to expand the awareness and use of farmers' markets, especially by low-income consumers.

State agencies which previously participated in the Farmers' Market Coupon Demonstration Project (FMCDP) mandated by the Hunger Prevention Act of 1988 (Pub. L. 100-435) were given automatic status as FMNP State agencies. New State agencies are to be brought into the Program through a competitive process, dependent upon the availability of funds. Interim FMNP regulations implementing the provisions of Pub. L. 102-314 were published in November 1992.

The FMNP legislation requires all States, current and prospective, to submit State plans for approval by FNS. Funds appropriated for this program are to be allocated first to the FMCDP States, i.e., Connecticut, Iowa, Maryland, Massachusetts, Michigan, New York, Pennsylvania, Texas, Vermont, and Washington. Remaining funds are then to be divided to fund expansion of current sites/services and to fund new State agencies. Congress earmarked $3 million of the FY 1992 WIC Program appropriation for the FMNP.

II. Human Nutrition Research Activities

A. General

Human nutrition research and education in USDA has traditionally been linked with the nutritive value of foods, human nutritional needs, the kinds and amounts of foods that Americans consume relative to their needs, and strategies for improving diets and the food supply. A major effort of USDA is to understand the relationship of food and its nutrients to health promotion in individuals at all stages of life.

The application of new nutritional knowledge often leads to changes in kinds and amounts of foods people consume, and thus the demand for food. Similarly, any improvement of the nutritional quality of the foods we eat must involve corresponding changes in the agricultural food system. Hence, the nutrition of individuals or population groups depends on all the factors that occur in the "food chain" before food becomes available for consumption, i.e., during production, processing and storage, and marketing. In recent years new types of foods have been introduced. To ensure an adequate supply of high-quality foods, an intimate knowledge of food composition, of the biological effects of food constituents, and of nutritional requirements and tolerances of humans is needed. This knowledge can be derived only through interdisciplinary efforts, connecting nutrition research with pre- and post-harvest agricultural science and technology. The value of the knowledge is achieved by educating the public and encouraging people to adopt the most healthful food habits.

The human nutrition research activities during 1992 are presented under six areas as detailed in the national plan. These are:

- Normal Requirements for Nutrients
- Role of Nutrition in Promoting Health and Preventing Diet-Related Disorders
- Food Composition and Nutrient Bioavailability
- Food and Nutrition Monitoring Research
- Food and Nutrition Information and Education Research
- Research on Government Policies and Socioeconomic Factors

USDA does not conduct research on the role of nutrients in the treatment of chronic diseases or disorders. It does, however, support research on health promotion or prevention of nutrition-related disorders, especially as related to fats, fiber, and complex carbohydrates and other components of foods and diets. The USDA program focuses especially on normal nutrient requirements and content and bioavailability of nutrients in foods.

In August 1992, a computer search was made of ongoing research in USDA relating to human nutrition, using the Human Nutrition Research Information Management System (HNRIMS). Table 1 shows the number of USDA research projects in most of the nutrition code categories under each of the six research areas listed. The table also shows the percentage of the total number of USDA projects that were coded for each of the categories. In addition, the percentage of the total number of research projects in HNRIMS for all Federal agencies which are USDA-supported projects is given by nutrition code category. The USDA projects include those conducted by the USDA agencies, the State agricultural experiment stations, and the 1862 and 1890 land-grant institutions and Tuskegee

Table 1. USDA Research in Human Nutrition (from HNRIMS, August 5, 1992)

HNRIMS Nutrition Code Area	USDA Projects		
	Number	%research in area	%federal
Normal Human Requirements for Nutrients			
1. Maternal	48	5.3	21
2. Infant and Child	51	5.6	15
3. Adolescent	14	1.5	20
4. Adult	85	9.3	49
5. Elderly	66	7.2	35
10. Immunology, Nutrition & Infec.	24	2.6	14
12. Genetics and Nutrition	41	4.5	20
13. Nutrition and Function	123	13.5	34
14. Nutrition Interactions	95	10.4	23
15. Other Conditions and Nutrition	41	4.5	8
Health Promotion & Prevention of Diet Related Disorders			
6. Cardiovascular Disease & Nutr.	80	8.8	14
7. Cancer	39	4.3	7
8. Other Diseases (e.g. Osteoporosis, Diabetes, etc.)	25	2.7	4
9. Trauma and Nutrition	4	0.4	10
11. Obesity, Anorexia, and Appetite Control	59	6.5	13
17. Carbohydrates	103	11.3	40
18. Lipids	229	25.1	34
19. Alcohols	6	0.7	6
20. Proteins and Amino Acids	152	16.7	38
21. Vitamins	133	14.6	23
22. Minerals and Trace Elements	185	20.3	37
23. Water and Electrolytes	11	1.2	9
24. Fiber	55	6.0	61
25. Other Nutrients in Foods	87	9.5	67
Food Composition			
26. Food Composition	218	23.9	91
27. Bioavailability of Nutrients	127	13.9	82
28. Effects of Technology on Nutritional Characteristics	214	23.5	95
29. Other Food Science Nutrition Monitoring	135	14.8	94
16. Nutritional Status	115	12.6	44
30. Food Consumption Surveys	47	5.2	71
31. Dietary Practices, Food Consumption Patterns	142	15.6	44
Nutrition Information and Education			
32. Methods for Informing Public about Nutrition	20	2.2	31
33. Other Nutrition Education Res	18	2.0	45
Effects of Government Policy			
34. Govt. Policy and Socioeconomics	70	7.7	89
35. Parenteral, Enteral, Elemental Nutr.	5	0.5	4

*Numbers are not additive as projects may be assigned to more than one nutrition code (911 USDA resaerch projects in system).

University. Some of these projects receive no Federal funds. The total Federal funds expended by USDA for human nutrition research in FY 1992 was $76.1 million.

The Agricultural Research Service (ARS) is USDA's principal research agency. Its research of human nutrition is conducted largely at five human nutrition research centers and at five regional research centers. The National Program Staff coordinates the research programs. Each center has different research objectives and contributes to solutions of high-priority national problems. The human nutrition research centers are listed following:

Beltsville Human Nutrition Research Center, Building 308, BARC-East, Beltsville, MD 20705; Dr. Joseph Spence, director, (301) 504-8157. Its history can be traced to 1894 when Federal funds were provided for nutrition research at Wesleyan University in Middletown, CT. It moved to Washington, DC, in 1906 and to Beltsville, MD, in 1941. Research is conducted to define the role of food and food components in reducing the risk of nutritionally related disorders among Americans. The research includes nutrient composition and nutritional qualities of food, energy metabolism, and nutrient requirements. Dietary strategies are developed, which can delay the onset of nutrition-related chronic diseases.

Grand Forks Human Nutrition Research Center, P.O. Box 7166, University Station, Grand Forks, ND 58202; Dr. Forrest Nielsen, director, (701) 795-8456. Established in 1970, the center focuses on defining human requirements for trace elements and the physiological and biochemical factors which influence those requirements.

Western Human Nutrition Research Center, P.O. Box 29997, The Presidio of San Francisco, CA 94129; Dr. Judith Turnlund, acting director, (415) 556-9697. Established in 1980, the center conducts research to develop improved methods for monitoring and evaluating human nutritional status, and to determine human nutritional requirements and factors that lead to malnutrition.

Human Nutrition Research Center on Aging, Tufts University, 711 Washington Street, Boston, MA 02111; Dr. Irwin Rosenberg, director, (617) 556-3330. The center was established in 1979. Research is conducted on the special nutritional needs of people as they age, with a view toward enhancing the quality of later life through improved nutrition and health.

Children's Nutrition Research Center, 1100 Bates Street, Houston, TX 77030; Dr. Dennis Bier, director, (713) 798-7000. The center was established in 1979 in connection with Baylor College of Medicine. Research is conducted on determining the unique nutrient needs of pregnant and lactating women and of children from conception through adolescence.

The USDA Cooperative State Research Service (CSRS) is the Agency in the U.S. Government that serves as an interface and coordinating mechanism between the Department of Agriculture research organizations, the 59 designated State and territorial agricultural experiment stations, and the 1890 Colleges and Tuskegee University. Money is appropriated by Congress by authority of the Hatch and Evans-Allen Acts, as amended, and administered through CSRS to States on a formula basis. Before the States can spend the money, projects are peer reviewed. The States have a large degree of freedom in allocating the money, other than submitting projects for approval and submitting annual progress reports. Research priorities are recommended by the State experiment station directors to the Department of Agriculture and then incorporated into the Department's annual request for funds from Congress.

Seven regional research projects typify areas of nutrition research currently underway at State agricultural experiment stations in cooperation with ARS, ERS, and HNIS. These are: (1) Nutrient Bioavailability; (2) Health Maintenance Aspects of Dietary Recommendations Designed To Modify Lipid Metabolism; (3) Behavioral and Health Factors That Influence the Food Consumption of Young Adults; (4) Nutritional Assessment in Older Adults: Diet Intake and Biochemical Studies; (5) Evaluation of Effective Intervention Methods To Improve the Quality of Well-being of Rural Elders; (6) Changing Patterns of Food Demand and Consumption Behavior; and (7) Dietary Fat and Fiber: Knowledge, Perceived Risk, and Dietary Practices. These projects deal with problems and opportunities to bring about the use of better nutritional practices in the general population.

The Nutrition, Food Quality, and Health Division of the National Research Initiative Competitive Grants Program (NRICGP) is also administered by CSRS. Two program areas were supported in FY 1992. The primary objective of the Human Nutrient Requirements for Optimal Health Program is to support research that will fill the critical gaps in our knowledge of human nutrient requirements. The Food Safety Program continued to emphasize increasing our understanding of the mechanisms of pathogenesis, prevention, and control of food-borne disease-causing bacteria. CSRS also administers the National Needs Graduate Fellowships Program which awards fellowships to colleges and universities in six areas of national needs, i.e., areas having shortages of expertise. In FY 1992, 21 fellowships covering Human Nutrition and Food Science were awarded.

B. Normal Requirements for Nutrients

1. Human Nutrient Requirements for Optimal Health Program within the National Research Initiative Competitive Grants Program (NRICGP)

The Human Nutrient Requirements for Optimal Health Program emphasized: (1) bioavailability of nutrients; (2) the interrelationship of nutrients; (3) nutrient requirements of healthy individuals across all age groups; (4) mechanisms underlying the relationship between diet and health maintenance, such as the effect of nutrients on the immune system; and (5) the cellular and molecular mechanisms underlying nutrient requirements, including the modulation of gene expression by nutrients. In FY 1992 the NRICGP Human Nutrient Requirements for Optimal Health Program was able to make 29 awards. A total of $3.6 million was awarded in this growing program. Listed below are the projects which were supported:

- Effect of Total and n-3 Polyunsaturated Fat on Physiologic Parameters, $69,963/1 year.
- Fifth Annual Symposium on Selenium in Biology and Medicine, $5,000/1 year.
- Estimating Vitamin A Status with Holo-Retinol-Binding Protein Concentrations, $55,044/2 years.
- Effect of Dietary Lipid on Carotenoid Absorption, $136,596/2 years.
- Regulation of Gene Transcription by Dietary Essential Fatty Acids, $250,000/3 years.
- Transcriptional Control of Lipoprotein Lipase by Cytokines, $148,401/2 years.
- Functions and Metabolism of Copper in T Lymphocytes, $231,703/3 years.
- Dietary Fiber and Lipoprotein Metabolism, $170,000/3 years.
- Manganese Requirements in Elderly Women, $40,000/1 year.
- Energy Requirements in Young Children and the Elderly, $120,000/2 years.
- The Vitamin K Status of the Breastfeeding Infant Beyond the Newborn Period, $135,000/3 years.
- Folate Nutritional Status and *In Vivo* Kinetics, $162,521/2 years.
- Nutrient Regulation During Reproduction and Growth (Conference), $5,000/1 year.
- Regulation of Apolipoprotein B Gene Expression by Dietary Copper Status, $150,146/3 years.
- Vitamin B_6-Riboflavin: Nutrient Interaction, Metabolism & Status in Women, $160,570/3 years.
- Dairy Lipids and the Gastrointestinal Barrier, $130,000/2 years.
- Calcium Requirements for Adolescent Females, $179,216/3 years.
- Metabolism and Bioavailability Determinants of 13C-Beta-Carotene in Humans, $160,000/2 years.
- Dietary Fiber in Blood Pressure Regulation, $180,000/3 years.
- FASEB Summer Research Conference: Vitamin C and Vitamin E in Free Radical Reactions, $4,500/1 year.
- Nutritional Importance of Pyrroloquinoline Quinone (PQQ), $41,552/1 year.
- Microvascular Responses in Copper Deficiency, $210,000/3 years.
- Nutritional Regulations of Plasma Homocysteine Levels, $133,105/2 years.
- Intestinal Calcium Absorption During Lactation and Weaning, $186,839/3 years.
- Effects of Diet and Hepatic Metabolism on Sulfur Amino Acid Requirement, $108,798/2 years.
- Methods To Assess Vitamin K Status, $140,000/2 year.
- Optimizing Nutrient Intake for Prolonged Visual Function, $140,000/2 years.
- Analysis of Carotenoids and Retinoids by Liquid Chromatography-Mass Spectrometry, $60,193/1 year.
- Interaction of Vitamin E and Fish Oil on Lipid Peroxidation in Older Women, $150,000/2 years.

2. Infants and Children

- Vitamin B_6 Status Linked to Infant Behavior

Studies at Purdue University explored the effects of vitamin B_6 deficits (ranging from marginal to severe) on developing brains in rats. Light and electron microscopy revealed striking effects of marginal vitamin B_6 deficits on neuron longevity and differentiation in certain regions of rat brain. In rats that were marginally deficient in vitamin B_6, the gross signs of central nervous system dysfunction included shrill cries, irritability, and aggravated startle responses. These observations caused the researchers to suspect vitamin B_6 inadequacy in some human infants.
During testing of infants, several showed inappropriate buildup to crying and frequent full-blown distress and were very difficult to console. An association between these behaviors and vitamin B_6 inadequacy was reinforced by a followup biochemical assessment of mothers and infants and by psychological and behavioral tests. These findings provide a basis for nutrition education and alleviation of the problem.

- Adolescent Obesity Strongly Related to Long-Term Health Risks

From an earlier Harvard University growth study, researchers at the Human Nutrition Research Center on Aging explored the relationship of adolescent obesity with disease and death among 500 lean and obese adolescents (Third Harvard Growth Study 1922-35). Death certificates and interviews were obtained to establish the facts and causes of death as well as medical histories.

Adolescent obesity was associated with increased risk of death from all causes in men, including coronary heart disease, but not in women. By age 73, men who were obese in adolescence were 50 percent more likely to die from any cause and twice as likely to die from cardiovascular disease than men who were lean in adolescence. Researchers observed higher risks of cardiovascular disease and atherosclerosis among elderly men and women who were obese in their teen years. Colorectal cancer and gout were greater among men, and the risk of arthritis and difficulty with routine activities of daily life were elevated among women. Adolescent obesity related more strongly to all of these poor health outcomes than adult obesity. Efforts to prevent and treat adolescent obesity are therefore essential.

• Chromium Content in Breast Milk Is Independent of Dietary Intake

Dietary chromium is important in normal sugar and fat metabolism. Insufficient chromium has been linked to maturity-onset diabetes and cardiovascular diseases. Scientists at the Human Nutrition Research Center in Beltsville, MD, have demonstrated that the dietary chromium intake of healthy breast-fed infants was less than 2 percent of the suggested safe and adequate dietary intake. Chromium content of breast milk was independent of dietary chromium intake and serum or urinary chromium values; chromium intake also did not correlate with serum or urine chromium. There was a significant relationship between concentration of chromium in serum and urine. The suggested safe and adequate dietary intake for infants needs to be reevaluated.

• Breast-fed Infants May Show Accelerated Maturing of Central Nervous System

Not all infants can or should be breast fed. Differences between breast and formula-fed infants can point the way for the best nourishment of all infants for growth and development. Scientists at the Children's Human Nutrition Research Center studied the sleep States (rapid-eye-movement [REM] sleep and nonrapid-eye-movement [NREM] sleep) and the energy expenditure of two groups of 4-month-old infants (one breast-fed and one bottle-fed). Formula-fed infants spent more time in REM sleep and had higher energy expenditures than breast-fed infants. Conversely, breast-fed infants spent more time in NREM sleep and had lower energy expenditures than formula-fed infants. The scientists suggest that the greater amounts of NREM sleep observed in breast-fed infants reflects accelerated maturation of the central nervous system.

• Simple Method To Determine Infant Body Composition

Measuring the density (densitometry) of an infant is important in analyzing body composition, which is an essential part of human nutrition research. The density of an infant is determined by measuring weight and volume. An acoustic plethysmograph was developed by scientists at the Children's Human Nutrition Research Center to provide routine total body volume measurements of preterm (1.5-3.0 kg) infants. Ten 1-minute measurements were made on 14 infants using this noninvasive and accurate technique.

3. Maternal Nutrition

• Two Disorders of Pregnancy May Be Separate Biochemical Diseases

A significant number of pregnant women develop a detrimental condition characterized by a marked increase in blood pressure and an abnormal amount of protein excreted in the urine. These women show a reduction in urinary calcium excretion, which can be detected before other signs of the condition are evident. The reduced urinary calcium loss may be caused by changes in hormones that regulate calcium metabolism. Some women have elevated blood pressure during pregnancy but do not have increased urinary protein excretion.

It is clinically important to find out whether biochemical tests can distinguish between these two groups of women. Researchers at the Human Nutrition Research Center on Aging compared various measures of calcium metabolism in normal pregnant women, pregnant women with increased protein excretion, and pregnant women with increased blood pressure alone. Their findings suggest that the two types of disorders of pregnancy may represent distinct and biochemically distinguishable diseases.

• Effects of Dietary Calcium and Iron Absorption and Retention

Iron deficiency is thought to be the most prevalent nutritional deficiency in the United States and throughout the world. Women during their reproductive years are one population subgroup that has a high incidence of iron deficiency anemia. Large numbers of women in this same age group consume less than the recommended daily amounts of calcium. Consequently, calcium supplements are often recommended and are widely advertised and consumed. Under some conditions, however, calcium salts apparently interfere with iron utilization. Scientists at the Plant, Soil, and Nutrition Laboratory, Ithaca, NY, found that the addition of calcium as a calcium carbonate exacerbated iron deficiency in anemic rats that were consuming a low-iron diet. These studies also indicated that calcium interference with iron absorption is primarily a function of the total amount of calcium in the diet. Studies suggest that within reasonable limits the deleterious effects of calcium additions on iron status can be prevented if iron intake is adequate. These studies should contribute to the development of strategies for overcoming calcium deficiency without increasing either the incidence or the severity of iron deficiency.

- Food Choices May Change During the Menstrual Cycle

Information about food consumption obtained from nationwide nutrition surveys is used for monitoring dietary practices and making policies. Recent research has indicated that the dietary intake of women may change over the course of the menstrual cycle--an effect not accounted for in most dietary surveys. Scientists at the Western Human Nutrition Research Center examined the effects of the menstrual cycle on food intake, urine volume, and urinary nitrogen levels when physical activity was held constant and an accurate dietary measurement method was used.

Nine women were allowed free choice of food and beverages, which were weighed and recorded by dietetic professionals for 52 days. The dietary intake data of the women suggest that under activity-controlled situations the menstrual cycle has no effect on energy, protein, and fat intakes but can alter food choices, which can in turn affect intakes of specific nutrients. On the days before menstrual bleeding, there was an increase in intake of soft drinks containing sugar and an increase in urine volume. The study results show that when studying the dietary intake of women, variables such as menstrual cycle and levels of physical activity must be incorporated into the study design in order to avoid erroneous interpretation of results.

4. Adult Nutrition

- Supplemental Vitamin A in Multivitamins Has No Effect on Vitamin A Status

Scientists at the Human Nutrition Research Center on Aging studied the relationship between vitamin A intake from multivitamins and vitamin A toxicity in 284 women age 40-70. Blood levels of vitamin A and markers of vitamin A toxicity were measured at time 0 and 1 and 2 years afterward. Dietary and supplemental intakes of vitamin A were measured by 3-day food records. There was no difference between supplement users and nonusers in vitamin A intake from the diet. Throughout the study, blood levels of vitamin A were not different between supplement users and nonusers.

For both supplement users and nonusers, the blood levels of vitamin A increased during the 2-year period. Blood levels of vitamin A were not related to vitamin A intake or age in either group. Blood measures of liver damage were not related to blood levels of vitamin A nor were they different between nonusers and users. This study suggests that supplemental vitamin A at doses contained in multivitamins does not pose a risk of developing vitamin A toxicity, nor is it beneficial when compared with normal dietary vitamin A consumption.

- Copper Enzymes in Blood Cells Are Good Indicators of Copper Status

The essential role of copper in human nutrition is well established. However, there is no general agreement as to appropriate methods for assessing copper nutritional status in an individual or a population. Scientists at the Grand Forks Human Nutrition Research Center have determined ranges for major indices related to copper in men and women ages 20-83. Some indicators were affected by factors other than copper nutritional status, while others were not. Copper status indicators that are now used, plasma copper and ceruloplasmin (a copper protein in plasma), were higher in women than in men, tended to increase with age, and increased with oral contraceptive use. Copper-containing enzymes in blood cells, such as superoxide dismutase and cytochrome c oxidase, and the ratio of the enzyme activity to immunoreactive ceruloplasmin were not as sensitive to gender- or age-related changes as the plasma indicators and thus may be better markers of copper nutritional status.

- Hormone Metabolism May Link Moderate Alcohol Consumption and Breast Cancer

Moderate alcohol consumption has been associated with an increased risk of breast cancer. One possible explanation is that alcohol consumption changes levels of hormones that affect the breast, and such hormonal changes increase the risk of breast cancer. Scientists at the Beltsville Human Nutrition Research Center carried out a controlled-diet study in which 34 premenopausal women consumed 30 gm of alcohol each day for 3 menstrual cycles and no alcohol for 3 cycles. Hormones were measured during the third cycle on each diet during the follicular, periovulatory, and luteal phases of the menstrual cycle.

Alcohol consumption was associated with increases in several estrogenic hormones in plasma and urine. The results of the study suggest that alcohol consumption may expose the breast to higher levels of total and bioavailable estrogens, and changes in hormone metabolism may provide a link between alcohol consumption and the risk of breast cancer.

5. The Elderly

- Assessing Iron Status in Elderly Women

The potential of plasma transferrin receptors as sensitive and rapid indicators of iron status has not been evaluated in an elderly population. Researchers at the University of Connecticut determined that most iron biochemical indices, including plasma transferrin receptors, in 70- to 79-year-old women were stable from day to day. However, serum iron and transferrin saturation have high variability. Single measurements of serum iron and transferrin saturation may be an unreliable index of iron status. The significance of this finding is that for diagnostic purposes, single measurements of most indices can be inaccurate.

In one elderly group that included individuals with inflammatory disease, plasma transferrin receptors were not specific in assessing iron deficiency; this observation warrants further investigation. In this population of women, the biochemical variables that differentiated iron deficiency from chronic disease (inflammatory disease) consisted of serum ferritin, erythrocyte sedimentation rate, and plasma transferrin receptors. These data support the use of these three indices in clinical diagnosis of iron deficiency among elderly women.

- Plasma Homocysteine Levels Related to Loss of Cognitive Function Among the Elderly

Homocysteine is an essential amino acid, but it becomes harmful when present in excess in the blood. Recent studies show that many patients with vascular disease, such as cardiovascular or cerebrovascular diseases, have high levels of homocysteine in their blood. This finding led to the suggestion that high homocysteine in the blood is similar to high cholesterol in contributing to arteriosclerosis and may also be harmful to brain function. Scientists at the Human Nutrition Research Center on Aging studied the relationship between depression, accompanied with loss of cognitive function or (dementia) in the elderly and the amount of homocysteine in the blood. Depression in this study group was of two kinds: one that was accompanied by signs of vascular disease (for example, hypertension and high cholesterol) and one that was not. Two important findings have emerged: (1) People with depression and vascular disease have higher levels of homocysteine in their blood than depressive people without vascular disease. (2) In the depressive group without vascular disease, there was a direct relationship between the amount of homocysteine in the blood and the severity of dementia; the higher the homocysteine in the blood the more severe the dementia. These findings reinforce the possibility that in addition to its potential effect on blood vessels, high homocysteine levels may be harmful to brain function.

- Vitamin C Intake and Blood Pressure in the Elderly

Elevated blood pressure is a powerful determinant of cerebrovascular and coronary heart disease. The importance of nutrition in controlling blood pressure is well documented, with obesity, dietary sodium, and alcohol associated with higher blood pressure and increased intakes of potassium and calcium associated with lower blood pressure. As the association of higher blood pressure and lower vitamin C has also been reported, scientists at the Human Nutrition Research Center on Aging undertook an analysis of data from a large cross-sectional study of the health and nutrition of a group of elderly people who were not in institutions. The researchers found fewer cases of elevated blood pressure in subjects who consumed 240 mg or more per day of vitamin C than they did in those who consumed less than 60 mg per day. This finding lends support to the hypothesis that diets low in vitamin C are related to increased blood pressure. Further research is required to test whether reduced vitamin C itself--or some other component of a low vitamin C diet--is responsible for the elevated blood pressure.

- The Dietary Energy Needs of Adults

Accurate recommendations on dietary energy (calorie) requirements form the basis for determining the amounts of food aid given to poor families and for assessing whether the food supply of different communities is adequate. Recommended dietary allowances (RDA's) for energy needs are based on theoretical calculations because it was not previously possible to directly measure actual energy needs in individuals who lead normal lives. Now, scientists at the Human Nutrition Research Center on Aging have successfully used the doubly labeled water technique to make direct measurements of the energy requirements of young and old men. Findings indicate that energy recommendations have substantially underestimated usual energy needs. Current RDA's may significantly underestimate usual energy requirements for physical activity. These new data contribute to a growing realization of the need to reevaluate energy intake recommendations and analysis of food consumption data.

- Body Mass Index

Obesity in middle age is associated with various morbidities including cardiovascular disease, adult-onset diabetes, and some types of cancer. Childhood obesity has been implicated as a possible risk factor for obesity in adulthood. Previous studies have shown that body size in childhood is a good predictor of body size in adolescence and early adulthood, but the degree to which weight in childhood predicts weight in middle age has not been established.

Studies at the Human Nutrition Research Center on Aging used height and weight data from an ongoing 50-year longitudinal study to investigate the relationship of body size in childhood to that of adolescence, young adulthood, and middle age. As expected, body size in childhood was a good predictor of body size up to 18 years of age. Sex differences also had an effect: In males, body size in childhood and adolescence was a good predictor of body size in middle age; in females, there was no relationship between body size in childhood and middle age.

6. Nutrient Functions

• Excessive Dietary Vitamin B_6 Affects the Central Nervous System

Excessive vitamin B_6 can be toxic to the peripheral nervous system, but many scientists think the central nervous system is protected from large doses of the vitamin. Excess vitamin B_6 might have subtle effects on the startle response, a central nervous system reflex controlled by brain compounds that require vitamin B_6 for their synthesis.

Researchers at the Western Human Nutrition Research Center assessed startle behavior in rats fed normal to excessive levels of vitamin B_6; the rats were kept in chambers that allowed measurement of the reflexive movement in response to sound. When a loud pulse of sound was administered alone, the startle response was lower in the groups fed the highest concentrations of vitamin B_6. The effect of diet was only marginally significant, however. When the loud sound was preceded by a quieter, nonstartling pulse of sound, the effect of diet was more pronounced. Rats fed 200 times the requirement or more had a significantly lower startle response than rats fed 1 or 10 times the requirement. Subtle changes in the startle response in rats fed large amounts of vitamin B_6 implies that the central nervous system is not completely protected from excessive vitamin B_6.

• A Model Found For Human Beta-Carotene Metabolism

The possible role of beta-carotene in cancer prevention has been proposed by human epidemiologic and animal studies. Unlike humans, most species (including rat, chick, pig, and sheep) break down beta-carotene in their intestinal tracts and absorb virtually none intact. Thus, in cancer prevention studies it is very difficult to separate the effects of beta-carotene from the effects of its products after breakdown. No convenient laboratory animal model mimics human beta-carotene metabolism in cancer studies.

In a recent study at the Human Nutrition Research Center on Aging, ferrets were used to determine the rate of beta-carotene uptake and absorption. The appearance of beta-carotene in the lymph, portal blood, bile, and intestinal scrapings after perfusion of beta-carotene through the small bowel was also studied in order to determine the appropriateness of this animal model for studies of beta-carotene metabolism. The studies demonstrated that the ferret, like the human, can absorb unchanged beta-carotene into the lymph and that some central cleavage of beta-carotene occurs in ferret tissue like in the human.

• The Effects of Exercise and Vitamin E on Defense Responses

Interleukin-1 (IL-1), tumor necrosis factor (TNF), and interleukin-6 (IL-6) are proteins that induce the host's defense responses to trauma and disease. Scientists at the Human Nutrition Research Center on Aging have been studying the production of these proteins and their plasma levels in individuals subjected to downhill running on a treadmill and supplemented with vitamin E. The day after exercise, IL-1 production increased in the cells of subjects taking a placebo but did not increase in cells of subjects taking vitamin E. TNF production also increased the day after exercise, although the response was not blocked by vitamin E. IL-6 production was unchanged after exercise, but vitamin E reduced the secretion of IL-6 at all times. Thus, immune factors seem to be related to changes in muscle protein, and vitamin E can affect these immune factors.

• High Dietary Fructose in Men Affects Plasma Cholesterol Concentrations and Signs of Short-Term Copper Deprivation

Animal experiments, epidemiologic studies, and human findings suggest that copper is more important in nutrition than generally recognized. One reason copper has not been well accepted as a nutritional concern is that attempts to produce signs of copper deprivation in adults have not yielded consistent findings. A study was performed at the Grand Forks Human Nutrition Research Center to see if cornstarch and fructose affected the response of men to short-term copper deprivation. Fructose can enhance the formation of active molecules known as free radicals, which cause tissue damage known as oxidant damage. Copper is part of the defense mechanism against this damage.

When compared with cornstarch, fructose increased serum cholesterol (mostly in the "bad" or LDL-cholesterol fraction) and altered the signs of copper deprivation associated with oxidative metabolism. This suggests that consumption of high levels of dietary substances that increase the formation of free radicals could make copper nutriture of concern.

• Zinc in Biliary-Pancreatic Secretion Is Independent of Dietary Zinc Intake

The amount of zinc retained by an animal depends on the amount absorbed from food in the gut, as well as the amount excreted and eliminated, primarily in the feces. A large proportion of zinc excreted in the feces comes from zinc in pancreatic fluid (which is involved in food digestion) and bile (which is involved in removing many substances from the body). Researchers at the Grand Forks Human Nutrition Research Center examined factors that influence the amount of zinc in bile and pancreatic fluid to determine whether an animal fed large amounts of zinc eliminates more zinc via this route than does an animal fed lesser amounts of zinc.

Results of the study show that greatly increasing zinc in the diet has relatively little effect on the concentration of zinc in bile and pancreatic fluid. On the other hand, the presence of food in the gut increased the amount of zinc in bile-pancreatic fluid almost seven-fold. There was also a seven-fold increase in the activity of digestive enzymes in the gut when food was present.

These results show that the amount of zinc in bile and pancreatic fluid primarily results from the secretion of digestive enzymes in response to the presence of food and that the amount of zinc in the diet has relatively little influence. This information is useful in determining the dietary requirement for zinc.

• The Role of Dietary Boron in Maintaining Normal Brain Function

Studies with humans suggest that the mineral boron may be required for normal brain function. However, the findings of previous human research may have been influenced by low magnesium intake. Scientists at the Grand Forks Human Nutrition Research Center studied the interaction of dietary boron and magnesium in rats. The electrocorticogram (ECoG)--a measure of brain electrical activity--was recorded from adult male and female rats following 75 days of a diet containing either 0 or 3 μg boron and either 100 or 300 μg magnesium. Dietary boron affected several characteristics of the ECoG in a manner suggesting that boron deprivation results in decreased alertness and responsiveness. The ECoG showed no effect of magnesium intake or of an interaction between boron and magnesium. These findings with rats extend those from previous studies with humans and provide additional evidence that boron helps maintain normal brain function.

• Human Dietary Requirement for Zinc

The human dietary requirement for zinc has been difficult to determine because regulatory controls on zinc metabolism are so strong. Researchers at the Grand Forks Human Nutrition Research Center studied 11 men who were fed different amounts of dietary zinc ranging between 1 and 4 mg zinc per day. These periods were compared with control periods when the men received 10 mg of zinc each day. Overall, the men's zinc balance (intake minus excretion) was negative only when they consumed 1.4 mg per day. Decreased urinary excretion and plasma zinc and signs of preclinical zinc deficiency were evident in men fed both 1.4 mg and 2.4 mg of zinc per day. Only one subject showed signs of preclinical zinc deficiency on a dose of 3.4 mg of zinc per day, suggesting that 3.4 mg daily may be an adequate zinc intake when zinc is highly available for absorption.

• Protective Cellular Mechanism Controls the Vitamin E Content of Red Blood Cells

Fish oil preparations containing polyunsaturated fatty acids of the omega-3 type have been proposed as dietary supplements to reduce the risk of heart disease. However, the biochemical and physiologic effects of these preparations have raised questions. Ingesting large amounts of polyunsaturated fatty acids may increase the risk of oxidative damage to these acids, and the fish oil supplements may cause the body to increase its requirements for vitamin E as an antioxidant.

Researchers at the Beltsville Human Nutrition Research Center examined the extent that dietary fish oil fatty acids are incorporated into the membranes of human red blood cells and the effects of the increased polyunsaturated intake on the vitamin E content of red blood cells. The fish oil treatment resulted in minimal incorporation of dietary fatty acids into the membranes; reduced membrane cholesterol; and increased vitamin E content in red blood cell membranes but not in the intact cell. Vitamin E thus became concentrated in the cell membranes during polyunsaturated fat feeding. The elevation in cell membrane vitamin E, without large supplements, suggests the existence of a mechanism at the cellular level to protect the integrity of the membrane by controlling the membrane's vitamin E content.

• Excess Calories Stored as Body Fats

Researchers at the Beltsville Human Nutrition Research Center investigated the efficiency of the human body in using dietary fats and carbohydrates. Ten volunteers received supplements of dietary fat or carbohydrate to a high- or low-fat diet. The diets varied widely in the percentage of calories from fat. When volunteers were fed at a calorie level above that required to maintain their weight, 90 percent of the additional calories were stored as fat whether or not the additional calories came from fat or carbohydrate. When the volunteers were fed diets at a calorie level below that required to maintain weight the body functioned more efficiently when the calories came from fat than from carbohydrate. This study suggests that approximately 90 percent of available calories in excess of the amount necessary to maintain weight will be stored as body fat.

• Typical American Diet Adequate To Maintain Aerobic Physical Activity

Past research has suggested that high carbohydrate intake is needed in order to maintain aerobic exercise, including running, walking, and cycling. Scientists at the Beltsville Human Nutrition Research Center conducted a study to determine the effect of moderate carbohydrate restriction on aerobic activity. Men included in the study were sedentary, aerobically trained, or weight-resistance trained. No significant difference in the men's ability to perform aerobic physical activity was found between two dietary periods--one high carbohydrate and the other moderately restricted carbohydrate. These results suggest that the carbohydrate range of 45-65 percent in the American diet is adequate for maintaining men's ability to perform aerobically.

• Indicators of Vitamin B_6 and Vitamin B_{12} Deficiency

Removal of homocysteine, a toxic amino acid product of cellular metabolism, requires several vitamins including vitamin B_{12}, folic acid, and vitamin B_6. It has been shown that deficiencies of vitamin B_{12} and folic acid are accompanied by elevated blood levels of homocysteine. These elevations are seen regardless of whether the blood samples are collected from subjects who fasted overnight or who recently consumed a meal. The amount of homocysteine in the blood, therefore, is a good indicator of a person's or animal's vitamin B_{12} and folic acid status.

Researchers at the Human Nutrition Research Center on Aging examined the effect of vitamin B_6 deficiency on blood levels of homocysteine. Surprisingly, they found that homocysteine levels were not elevated in blood samples taken from B_6-deficient humans or rats that fasted overnight. It was concluded that blood homocysteine level is not a good indicator of vitamin B_6 status.

C. Role of Nutrition in Promoting Health and Preventing Diet-Related Disorders

1. Body Composition

• The Effects of Underfeeding on Energy Expenditure and Nutrient Intakes

How the human body regulates its weight is not well understood. Scientists at the Human Nutrition Research Center on Aging recently observed the effects of intentional underfeeding on normal-weight young men who had high levels of energy expenditure and who led unrestricted lives. The men were underfed by 800 kcal a day, for 20 days. Researchers found that energy expenditure did not fall significantly with reduced energy intake. They also found that, following the dietary restriction, the subjects' voluntary energy intake initially increased above the basic amount required to maintain body weight, was proportional to the weight loss during underfeeding, and rapidly restored the weight lost during underfeeding. These results indicate: (1) that appetite--rather than adaptive variations in energy expenditure--plays the dominant role in day-to-day regulation of body weight; (2) that energy balance is regulated primarily by adaptive variations in energy (food) intake; and (3) that the hypothesis that energy-wasting mechanisms contribute substantially to body energy regulation is not confirmed.

• Exercise Plus Diet Reduction Leads to Change in Body Water, Not Protein Composition of Fat-Free Mass in Obesity

Scientists at the Western Human Nutrition Research Center examined changes in fat-free mass (muscle, bone, and water) in 10 obese women who participated for 12 weeks in either a diet-plus-exercise regimen or an exercise-only program. Exercise consisted of walking 6 days a week at a rate that expended 15 percent of their energy needs.

The diet-exercise group had a 50-percent reduction in energy intake. Average weight loss was 12.8 kg (28 lb) for the diet-exercise group and 4.3 kg (9.5 lb) for the exercise only group. The diet-exercise group lost three times more fat-free mass than the group that only exercised. An analysis of nitrogen lost in urine, feces, sweat, and blood suggested that the loss of fat-free mass was not the result of loss of body protein. Measurements of bone mineral content and density showed no changes in this body compartment during the study. Measures of body water changes confirmed that the changes in fat-free mass were due to changes in body water. This study demonstrated that body protein remains relatively intact during periods of increased exercise and periods of dietary restriction with exercise in obese women.

2. Dietary Lipids

• Oxidized Lipids and Atherosclerosis

The possible relationship between consumption of oxidized lipids (which can be found in fried potatoes, chicken, and fish) and the development of coronary heart disease is not clearly established. Researchers from the University of Minnesota found that many raw or minimally processed animal products contain extremely small quantities of cholesterol oxidation products; that certain highly processed products contain high levels of these products; and that cholesterol oxidation products are quickly absorbed and later cleared from the bloodstream when fed to humans in the form of powdered eggs. The scientists observed that in subjects fed a diet with increased levels of antioxidants, the circulating cholesterol oxidation products levels dropped 76 percent in 3 weeks. They also observed that some people naturally have higher levels of circulating cholesterol oxidation products. The scientists are studying whether or not these findings can be related to development of atherosclerosis.

• Cholesterol-Raising Effects of Palmitic and Stearic Acid

Palmitic and stearic acids are the predominant saturated fats in the American diet. Palmitic acid increases serum cholesterol to a greater extent than stearic acid, but the reason for the difference is not known. Human studies done at the Food Quality and Safety Research Center, Peoria, IL, have identified a possible explanation. Tagged stearic acid was converted more extensively to a noncholesterol-raising compound than tagged palmitic acid. These are the first results in a human study to identify a metabolic reason for the different cholesterol-raising effects of palmitic and stearic acids. A two-fold difference was seen among individuals in the conversion. The variation between people suggests why some individuals tolerate a diet high in palmitic and stearic acids better than others.

• The Effects of Linolenic Acid on Blood Lipids, Blood Coagulation, and Immune Function

An increase in the concentration of cholesterol in the blood is one of the risk factors for cardiovascular illness. The concentration and type of dietary fats have been reported to affect blood cholesterol levels. While marine or plant oils lower blood coagulation and blood pressure, their effects on blood cholesterol are contradictory. Scientists at the Western Human Nutrition Research Center examined the effect of flax seed oil (which contains approximately 60 percent by weight of the 18 carbon omega-3 fatty acid alpha-linolenic acid or ALA) on blood lipids and blood coagulation in 10 healthy men who had normal lipid levels. Feeding the men 10 percent of their calories from flax seed oil for 56 days altered neither the indices of lipid status (serum cholesterol, high-density lipoprotein, low-density lipoprotein, Apo A-1, Apo-B, triglycerides) nor the indices of blood coagulation. Researchers also reported that the diet suppressed some of the indices of immune status in these same subjects.

Thus, moderate levels of flax seed oil or other oils containing ALA may be incorporated into the diets without adverse effects on blood lipids and blood coagulation. However, the long-term effects of such diets on immune status need further study before recommendations can be made regarding the intake of ALA.

• Conversion of Linolenic Acid Sufficient in Typical Diets

The ratio of linolenic to linoleic acid in dietary fats influences the ratio of omega-3 and omega-6 fatty acids, which is critical to good health. For example, to maintain normal blood-clotting rates, brain and nerve function, eyesight, and immunological function, the body must control the omega-3 to omega-6 ratio in tissues.

Stable isotope-labeled linoleic and linolenic acids were used to investigate the influence of two levels of dietary linoleic acid on the metabolism of these fatty acids in humans. The results indicate that conversion of linolenic acid to omega-3 metabolites was impaired by increasing the level of linoleic acid in the diet. Even so, researchers from the Food Quality and Safety Research Laboratory, Peoria, IL, estimate that conversion of linolenic acid is sufficient to meet nutritional requirements when the average American diet is consumed.

• Diet High in Fish Affects Inflammatory Immune Responses

Reducing dietary fat, saturated fat and cholesterol is recommended by public health organizations to reduce the risk of heart disease. Very few studies, however, have examined the effects of these changes on human cytokine production and immune responsiveness. Twenty-two men and women over age 40 volunteered at the Human Nutrition Research Center on Aging in a 30-week study. During the first phase (6 wk), the volunteers ate average American diets. During the second phase (24 wk), volunteers ate either (1) a low-fat and low-cholesterol diet, following the National Cholesterol Education Program (NCEP) step 2 recommendations for polyunsaturated fatty acids derived from fish, or (2) a diet low in fish-derived polyunsaturated fatty acids but high in plant-derived polyunsaturated fatty acids, following NCEP step 2 recommendations. The results show that the fish diet had significant adverse effects on inflammatory and immune responses. Thus, changes in immune response should be taken into consideration when diets are recommended to prevent chronic diseases; a variety of fat sources should be consumed.

• Lean Subjects Who Drink Moderate Amounts of Alcohol Have Higher Levels of "Good" Cholesterol

Cholesterol is carried in the bloodstream by different particles. High density lipoprotein (HDL) particles carry the so-called "good cholesterol" and contain a protein called apolipoprotein A-1 (apo A-1). Subjects with low levels of HDL cholesterol and apo A-1 in their plasma are at increased risk for heart disease.
Scientists at the Human Nutrition Research Center on Aging measured the plasma levels of HDL cholesterol and apo A-1 in 1,344 men and 1,337 women participating in the Framingham Offspring Study and found that women have higher plasma levels of HDL cholesterol and apo A-1. They also found that subjects with very low HDL cholesterol and apo A-1 had markedly higher body weights and significantly higher plasma triglycerides than subjects with very high HDL cholesterol and apo A-1. Plasma levels of HDL cholesterol and apo A-1 were higher in those subjects who drank at least one alcoholic beverage per week (beer, wine, or liquor) than in those who abstained. These results indicate that people who are lean and whose alcohol use is moderate have higher levels of "good cholesterol" than others. Health advisors do not recommend that abstainers become alcohol consumers because of known adverse outcomes of alcohol consumption.

• Vitamin E Corrects Dietary Fish Oil Negative Effect on Blood Platelet to Conversion of Beta-Carotene to Vitamin A

The observation that Eskimos and Japanese fishermen are relatively less prone to coronary artery disease and cancer led to the hypothesis that their diet, which is rich in fish products, has a protective influence against these conditions. Marine fish oils rich in omega-3 fatty acids have been postulated to possess these beneficial characteristics.

In a study from the Beltsville Human Nutrition Research Center, 41 adult men were placed on a standardized diet for 10 weeks that included 15 capsules of a control fat resembling the fat in the diet. At the end of the period, they continued to eat the same diet but switched to 15 capsules (1 gm each) of fish oil per day. After 10 weeks, they were given a supplement of 200 International Units of vitamin E every day for 8 weeks.

Blood samples were collected at the end of each experimental period and separated into plasma, red blood cells, and platelets. Each blood component was analyzed for vitamin E (alpha-tocopherol), vitamin A (retinol), and beta-carotene. Fish oil depressed platelet retinol and elevated beta-carotene, a change that was reversed upon administering additional vitamin E. Thus, platelets have the capacity to convert beta-carotene to vitamin A (which was not known before), and fish oil depresses this function. Concurrent administration of vitamin E reverses the effect. The results suggest that concentrated fish oil should be used with caution.

• Moderate Alcohol Consumption Improves Blood Lipoproteins in Women

Information is sparse on how alcohol affects the plasma lipoproteins of women. In a study from the Beltsville Human Nutrition Research Center the effects of two alcoholic beverages a day on the lipoproteins of premenopausal women were measured while controlling the subjects' diet and a number of other potentially confounding variables, including phases of the menstrual cycle. Alcohol and no-alcohol treatments were administered to all subjects, and blood was taken for analysis during the 3rd month of both treatments.

High density lipoproteins (HDL's), which are thought to protect against heart disease, increased by 9 percent when the women consumed alcohol. Low density lipoproteins (LDL's), which are associated with heart disease, decreased 8 percent. Another lipoprotein that is independently associated with heart disease, lipoprotein(a) [Lp(a)], was unchanged with alcohol.

The increase in HDL's was due to an increase in the major HDL components HDL2 and HDL3. The changes observed in lipoproteins are consistent with changes thought to confer protection against coronary heart disease. It is well known, however, that alcohol has many adverse effects on health and behavior, so any beneficial effects of alcohol consumption must be considered in the context of overall health.

3. Dietary Fiber and Carbohydrates

• Type of Fiber Differentially Affects Gut Cell Proliferation

Research was conducted at Texas A&M University on the interactive effects of fibers and fats on colon physiology to provide a better understanding for prevention of colon cancer. Major findings were that different fibers have differential effects on colon physiology and the effects are site specific and dependent upon the type of dietary fat. For example, wheat bran and cellulose, which are the less fermentable fibers, result in a more quiescent pattern of cell proliferation in the colon, which should be protective against colon cancer. Fish oils produced the most protective patterns when compared with beef tallow or corn oil.

The main effects of fibers were observed in the proximal colon, and the main effects of fat were seen in the distal colon. Interactive effects were seen proximally and distally. For example, pectin stimulated cell proliferation in the proximal colon but only when the source of lipid in the diet was corn oil. These findings explain some of the current confusion about the role diet plays in the development of colon cancer.

• Starch Bioavailability in the Upper Gastrointestinal Tract

Fiber is a complex mixture of polymers, and it is generally recognized that different fibers have different effects. Some fibers decrease the incidence of colon cancer in laboratory animals and other fibers have no effect or increase the incidence of the disease. Researchers at the University of Wisconsin proposed that fiber has these differential effects on the colon because of differences in its fermentation (the bacterial decomposition of carbohydrate, including fiber, in the large intestine). Some fibers appear to be completely fermented, others not at all. The researchers studied the material discharged by the small intestine into the colon (which is the substrate available for fermentation by the bacteria) and found that it is more complex than the dietary fiber measured in the food.

In addition to the food-derived fiber, digesta from the small intestine contains two other sources of carbohydrate, endogenous secretions and sometimes starch. The presence of fiber in the gastrointestinal tract increases the endogenous secretions. Baking food that contains flour makes a small amount of the flour starch indigestible. In legumes, larger amounts of starch (10-20 percent) are not digested. Starch and endogenous secretions effectively increase the amount of fermentable material and confound studies of fiber.

Methods were developed to study the rates at which these different materials are fermented. Recent findings suggest that bacteria degrade endogenous material and soluble dietary fiber first. This may explain why soluble fibers do not eliminate constipation: They are rapidly degraded in the first part of the large intestine and are, therefore, unavailable to contribute bulk to the stool.

• Beneficial Starch in Corn Meal Is not Affected by Corn Fiber

Elevated blood glucose or insulin after a glucose tolerance test is a common indication of abnormal carbohydrate metabolism. As people age, a greater percentage show high responses. The simplest treatment would use diet to control the level of blood glucose.

Some fibers have been shown to lower the glucose response. Corn starch in which 70 percent of the starch is structured as a straight chain (amylose) has been reported to give a lower insulin response than standard starch structured with the more common branched chain amylopectin. Corn meal contains a significant amount of fiber.

Scientists at the Beltsville Human Nutrition Research Center investigated whether there is an interaction between the fiber in corn meal and its unique type of starch on glucose or insulin response. Twenty subjects consumed corn chips or muffins that were prepared with or without corn meal. Nine of the subjects had elevated insulin response to a glucose tolerance test. Insulin response, but not glucose response, decreased significantly when corn containing amylose was consumed, compared with the responses of both normal and high insulin responders after standard starch (amylopectin). Corn fiber did not significantly change any response curves. No interaction was found between fiber, starch, or insulin response to glucose. The amylose starch from corn was found to be beneficial and was not affected by the corn fiber.

• Cholesterol-Lowering Effect of Rice Bran Stems From Many Factors

Scientists at the Western Regional Research Center evaluated the effect of low-temperature (4°C) versus high-temperature (54°C) extraction on the cholesterol-lowering activity of defatted rice bran and rice bran oil on hamsters with high cholesterol levels. The cholesterol-lowering effects of rice bran oil fractions (gum, wax, and degummed-dewaxed oil) were also investigated.

Results showed that low-temperature extraction did not result in any improved health-promoting properties of defatted rice bran or rice bran oil. The cholesterol-lowering properties of full-fat rice bran were present to a lesser extent when degummed-dewaxed rice bran oil was recombined with defatted rice bran, suggesting that some active components were lost or deactivated in the fractionation process. The cholesterol-lowering activity of full-fat rice bran, therefore, appears to be multifactorial and requires the presence of several components in their native State, including the fiber and lipid fractions.

4. Vitamins and Minerals

• Relationship of Vitamin C Status to Cholesterol Levels and Blood Pressure

Elevated blood levels of high-density lipoprotein cholesterol (HDLC) reduce the likelihood that an individual will develop heart disease while elevated blood pressure levels increase one's risk. There is growing belief that vitamin C may also decrease the risk of heart disease, because vitamin C status may alter HDLC levels and blood pressure.

Four studies conducted at the Human Nutrition Research Center on Aging examined the relationships between blood vitamin C, HDLC, and blood pressure. These studies included 911 women and 663 men ranging in age from 19 to 100 years. Individuals were grouped into four categories based on their blood vitamin C levels (less than 40, 40-59, 60-79, and more than 80 mol/L). HDLC levels for individuals in the highest vitamin C category were 9.5 percent greater than those for individuals in the lowest category. Low-density lipoprotein cholesterol levels were also 7.5 percent lower in the highest vitamin C category but only among individuals younger than 60. Systolic and diastolic blood pressure levels were 5 percent and 6 percent lower among individuals in the highest vitamin C category compared with those in the lowest category.

Although these data strongly suggest that vitamin C may be involved in the regulation of these heart disease risk factors, the possibility cannot be excluded that these observed relationships are the result of other differences among individuals with high and low vitamin C status, such as differences in diet and exercise.

• Linseed Oil and Ground Flaxseed Show Antimalarial Activity in Vitamin E-Deficient Mice

Malaria is a serious tropical disease that accounts for over a million deaths a year. Many commonly used antimalarial drugs no longer kill the parasite and an effective vaccine seems many years off. However, growth of the parasite can be suppressed by manipulating the diet fed to the host.

Weanling male mice were fed for 2 or 4 weeks on a purified diet with or without supplemental vitamin E. The source of dietary lipid was lard, linseed oil, or ground flaxseed. Mice fed the vitamin E-deficient diet, containing linseed oil or ground flaxseed, had significantly lower blood parasite activity 6 days after malarial infection than mice fed either the unsupplemented lard diet or any of the vitamin E supplemented diets. These mice also had greatly improved survival after 60 days. The antimalarial effect of these diets was more pronounced in the groups fed the diets for 2 versus 4 weeks. Scientists at the Beltsville Human Nutrition Research Center conclude that dietary manipulation may offer promise as a means of malarial control.

• Moderate Folate Deficiency Increases Cancer Risk

Some studies have shown an association between deficiency of the vitamin folate and the development of precancerous changes in certain tissues. Scientists at the Human Nutrition Research Center on Aging questioned whether folate deficiency would enhance the risk of developing precancerous and cancerous changes in the large bowel of the rat.

Weanling male rats were treated with a carcinogen and fed an amino acid-defined diet containing either 8 or 0 mg/kg folic acid for 5 weeks. Thymidylate synthesis (a folate-dependent pathway) was abnormal in the folate-deficient rats, and there were significant differences in the incidence of abnormal growth in the colon (colonic neoplasia) between the two groups at 20 weeks. The results clearly indicate that moderate folate deficiency in rats does increase the risk of cancerous changes.

• Selenium Deficiency Induces Heart-Damaging Effects From a Normally Benign Virus

Keshan disease, congestive heart failure from a damaged heart muscle, is responsible for thousands of deaths each year in China. The disease appears to be due to a deficiency of the essential trace element selenium, since supplementing selenium-poor populations with the mineral prevents the disease. However, seasonal variation in the incidence of the disease suggests an infectious component. Studies at the Beltsville Human Nutrition Research Center showed that selenium-deficient mice are susceptible to the heart-damaging effects of a virus, CVB3, that causes no harm in normal mice. The study demonstrates that nutritional deprivation can cause the host animal to become vulnerable to heart damage from a normally benign virus. The reason for this effect is not known but may be related to abnormal immune function due to impaired antioxidant defenses in the host. These results indicate the importance of nutritional status in determining the outcome of viral infection.

• Nickel and Vitamin B_{12} May Have a Common Biological Site of Action

Evidence that the element nickel is essential for laboratory animals indicates that it may also be nutritionally important for humans. In laboratory animals, nickel seems to have a biological role that affects the same biochemical systems as vitamin B_{12}.

To determine how these two nutrients interact, researchers at the Grand Forks Human Nutrition Research Center determined the effect of nickel deprivation in severely vitamin B_{12}-deficient rats. The rats were exposed to nitrous oxide, an anesthetic gas that combines with and inactivates vitamin B_{12}, producing a State similar to vitamin B_{12} deficiency.

The results showed that administration of nitrous oxide apparently masks the signs of nickel deprivation, thereby indicating that interfering or blocking the pathways in which vitamin B_{12} is important also blocks the pathways in which nickel is important. These results offer further evidence that nickel and vitamin B_{12} have a common biological site of action.

• Dietary Boron Important for Proper Bone Development

The element boron when fed to laboratory animals at concentrations similar to those found in human diets rich in fruits and vegetables, affects blood biochemical markers of energy and mineral metabolism. In a series of animal experiments, researchers at the Grand Forks Human Nutrition Research Center observed that adding boron to the diet had more of an effect on indices of energy metabolism when the animal was vitamin D_3 deficient. To confirm and expand that finding, day-old chicks were fed a diet that contained inadequate amounts of boron and vitamin D_3. Other groups of chicks received diets with adequate amounts of boron, or vitamin D_3, or both. After 26 days, the group receiving inadequate boron and vitamin D_3 showed changes in their blood sugar and fats similar to those described in rats with diabetes. Adding boron to the rats' diet substantially alleviated many of those changes. When the chicks were fed adequate vitamin D_3, boron did not have much effect on blood sugar and fat levels but did seem to help bone growth.

The body seems to carefully control boron absorption because increasing the amount of dietary boron ninefold caused boron concentrations in the blood to rise only by a factor of two. The findings suggest that boron in the diet is important for the proper development of bone and helps regulate the use of energy sources.

- Anthropometric Study of Bone Loss Over Two Decades

Bone measurements and dietary data were obtained from 744 men and women from one community in a study at the Human Nutrition Research Center on Aging. Bone loss was found to begin by age 50 and increased thereafter. Although net bone loss was nearly as great in men as in women, bone loss over two decades constituted a larger percentage of the initially smaller bone mass in females. Trends in bone changes over the two decades were not affected by smoking, alcohol, antihypertensive medication, or early menopause. Long-term bone changes were independent of energy and mineral intake. Although dietary intake cannot be used to predict long-term bone changes, the amount of initial bone tissue was highly correlated with bone tissue 21.4 years later in life for both sexes.

- High Levels of Calcium-Regulating Hormone May Prevent Osteoporosis

Why African-Americans have greater bone mass and less osteoporosis than European-Americans has focused research on differences between the two groups in calcium-regulating hormones. Scientists at the Human Nutrition Research Center on Aging measured fractional calcium retention (an index of calcium absorption) and the calcium-regulating hormone 1,25-dihyroxyvitamin D 1,25(OH)2D in healthy women--15 African-American and 15 European-American on high- and low-calcium diets. Calcium retention was similar in the two groups, but plasma 1,25(OH)2D was higher in the African-American women on both diets. At low concentrations, 1,25(OH)2D stimulates calcium absorption, and at higher concentrations it favors a greater calcium content in bone. So, African-Americans may have an intestinal resistance to the action of 1,25(OH)2D that leads to their higher blood levels, which may contribute to their greater bone mass. The study suggests that use of chemical derivatives of the naturally occurring 1,25(OH)2D may be an effective approach to preventing osteoporosis.

D. Food Composition and Nutrient Bioavailability

1. Improved Methods

- Simple, Rapid, Official Method for Determining Total Dietary Fiber in Products With Little or No Starch

A simple and rapid method for determining the total dietary fiber content of foods containing little or no starch was developed at the Beltsville Human Nutrition Research Center. The method is simplified by not requiring any buffer or enzyme. Nine laboratories tested the method in a roundrobin study, and statistical results indicate the method has excellent reproducability and repeatability. It is being submitted for adoption to the Association of Official Analytical Chemists International. A simple method for total dietary fiber will aid in meeting nutrient labeling requirements.

- New Technique for Studying Carbohydrate Structure in Foods

Carbohydrates (sugars) make up the largest part of an infant's diet. To fully understand how infants digest carbohydrates and how the body uses carbohydrates in growth and development, scientists must understand the physical structure of the many different kinds of carbohydrates. Researchers at the Children's Nutrition Research Center developed a new technique for separating the different carbohydrates in foods from one another, identifying them, and studying their structure. This technique will be useful in further studies of the development of the human gastrointestinal system.

- High-Precision Method Developed for Studies of Molybdenum Metabolism in Humans

Little is known about the human dietary requirement for molybdenum, though it is known to be an essential nutrient. This lack of knowledge is due in part to the absence of a suitable, high-precision method for molybdenum analysis and in part to the fact that radioactive isotopes of molybdenum cannot be used for metabolic studies in healthy people. Molybdenum does, however, have seven stable nonradioactive isotopes, which can be used as multiple tracers. A high-precision method incorporating stable isotopes of molybdenum was developed at the Western Human Nutrition Research Center to determine the molybdenum content of biological samples. By using this methodology stable isotopes can be used in studies of the molybdenum requirement and molybdenum metabolism.

- Official Method Simplified for Finding Cholesterol in Multicomponent Foods

There is a critical need for accurate, precise, and rugged chemical methods for determining the level of cholesterol in food combinations. The Official Method of the Association of Official Analytical Chemists International has been simplified and updated by scientists at the Beltsville Human Nutrition Research Center. The quantification of cholesterol is achieved with capillary gas-liquid chromatography using the internal standardization technique. The lipid extract is prepared for chromatography by a brief saponification carried out in a tube. The resulting method has been validated using Standard Reference Materials and the method of standard addition. As a result, there is now a practical alternative that is more reliable and less expensive than earlier methods.

• Quantitative Methods Developed for Forms of Ascorbic Acid in Foods

The vitamin C content of foods must be listed under new labeling laws. For quality control and monitoring programs, it will be necessary to distinguish ascorbic acid and its epimer, erythorbic acid (isoascorbic acid). An analytical method for the determination of ascorbic acid, dehydroascorbic acid, and their epimers--isoascorbic and dehydroisoascorbic acid--in foods has been developed over the past decade at the Beltsville Human Nutrition Research Center. It is applicable to a large variety of samples and has been found to be reliable and sturdy for thousands of samples without loss of precision and accuracy. It should be of use to the Food and Drug Administration and the USDA Food Safety and Inspection Service for monitoring label values.

• Methodology Developed To Measure Large Number of Carotenoid Components in Blood

Many fruits and vegetables contain a variety of carotenoids, including beta-carotene, which is one group of micronutrients that may reduce the risk of cancer. Determining how carotenoids act in disease prevention requires the ability to identify and measure a large number of these components in the blood of human subjects. Scientists at the Beltsville Human Nutrition Research Center have separated and identified 18 carotenoids, vitamin A, and two forms of vitamin E in extracts of human plasma. Ten of the carotenoids were identified and characterized in plasma for the first time. The procedures will enable nutritionists, epidemiologists, and other scientists to identify the precise role carotenoids play in reducing the risks of disease.

• Fat Components Exhibit Long-Term Stability in a Frozen Diet Reference Material

The stability of total fat, fatty acids, cholesterol, and moisture in a frozen total-diet control material was monitored for 36 months in a study conducted at the Beltsville Human Nutrition Research Center. The frozen slurry was formulated from samples of approximately 200 foods obtained from the Food and Drug Administration's Total Diet Study. Results show no significant changes in the levels of fatty acids, total fat, cholesterol, or moisture over the duration of the study. This study indicates that a wet frozen dietary material can be used to monitor accuracy in total fat, fatty acid, and cholesterol analyses in diet composites.

• Stable Isotope Method Allows Study of Calcium Metabolism in Preterm Infants

Bone mineralization is often poor in preterm infants. An automated, high-precision method was developed at the Western Human Nutrition Research Center to measure ${}_{44}$Ca, a very rare stable isotope of calcium, by thermal ionization mass spectrometry. The method makes it possible to use a very small amount of the isotope to study the absorption and excretion of calcium from infant formulas, human breast milk, and fortified human milk in very-low-birthweight, preterm infants. The use of a stable isotope of calcium offers a major advantage in studies of infants because there is no exposure to radioactivity and the isotope is otherwise completely safe. Studies using the approach should provide information on the level and form of dietary calcium that maximize absorption and retention by preterm infants, thereby improving bone mineralization.

2. Food Composition

• High-Fiber Muffins Developed

High-fiber, high-carbohydrate diets have been associated with prevention and treatment of diseases such as coronary heart disease and diabetes. Scientists at the Western Regional Research Center have developed acceptable formulations for high-fiber muffins containing oat bran, barley beta-glucans, or rice bran. The large (100 g) experimental muffins supplied more than 7 g of the total dietary fiber compared with about 3 g in a commercial oat bran muffin. High-fiber muffins contained more moisture, protein, and minerals (ash) and fewer calories than the commercial muffin. The rate of starch digestion, which has been correlated with effects on blood glucose when starchy foods are consumed, was relatively low for all of the muffins. These formulations will provide guidelines for the development of new cereal products for health-conscious consumers.

• Provisional Table on the Selenium Content of Foods

Since 1975, selenium has been recognized as an essential nutrient, and in 1989, a Recommended Dietary Allowance (RDA) was established for the element. Acceptable data were combined to provide estimates of selenium content and variability for each food. Using these estimates more than 200 foods (representing more than 1,000 analytical samples) were analyzed in a 3-year collaborative study between scientists at the Beltsville Human Nutrition Research Center and the Human Nutrition Information Service. The study resulted in the first comprehensive tables of selenium composition of foods. Meats and poultry products, selected fish, and grain products have the highest amounts of selenium. Fruits, vegetables, and fats and oils contain low levels of selenium.

When determining the importance of a single contributor, such as selenium, to the dietary intake of an entire population, it is important to combine analytical data with consumption data. A single food with a low concentration of the element may be an important contributor when the amounts of foods consumed are considered.

• New Carotenoid Data Base Developed

Understanding the association between the dietary intake of carotenoids and the incidence of cancer requires accurate and current data for specific carotenoids in foods customarily eaten in the United States. In a collaborative effort between the Beltsville Human Nutrition Research Center and the National Cancer Institute, Bethesda, MD, scientists developed a carotenoid data base (Recipe Carex Data base) for single and multicomponent foods.

The new data base contains quality estimates of five carotenoids (alpha-carotene, beta-carotene, beta-cryptoxanthin, lycopene, and lutein) in over 2,300 fruits, vegetables, and multicomponent foods containing fruits and vegetables. These data were then combined with food consumption data from 1986 Continuing Survey of Food Intake by Individuals, to rank foods according to the specific carotenoid they contribute to the diets of 19- to 50-year-old women.

• Microbiological Assay for Chemical Species of Selenium in Foods

A bioassay has been developed to approach the problems inherent in the numerous chemical species (different chemical linkages) of selenium in food. Different forms have different bioavailability and use of a bioassay is better than use of chemical assay. This assay, developed by researchers at the Beltsville Human Nutrition Center, takes advantage of the presence in *Escherichia coli* of formate dehydrogenase enzymes that require selenium for synthesis. Formate dehydrogenase catalyzes the formation of carbon dioxide from formic acid (a metabolite of sugar fermentation). Various selenium compounds utilized in formate dehydrogenase production can be quantitated by measuring evolved carbon dioxide. This assay is sensitive at the picomoles/mg level of selenium in food, with linear dose response curves over several orders of magnitude, extending down to the picomoles/ml range for selenomethionine, selenocystine, and sodium selenite. A dose-response relationship to acid hydrolyzates of a wheat gluten reference material (RM) obtained from the National Institute of Standards and Technology (RM 8418) has been demonstrated.

• National Nutrient Data Bank

HNIS continues to maintain and expand components of the National Nutrient Data Bank (NNDB) as the primary mechanism for collecting, evaluating, storing, and collating data on nutrient composition of foods. Products of the NNDB are reference values for over 60 food components in thousands of foods Americans consume, including many foods consumed primarily by specific ethnic groups. They are presented in published tables and reports, provisional tables, and machine-readable forms for a wide variety of users. The products are widely recognized as authoritative and are used throughout the world. Of special importance are the data bases prepared for use in assessing the nutrient content of diets reported in large-scale dietary intake surveys conducted by HNIS and by the National Center for Health Statistics (NCHS) in DHHS. In addition, HNIS has supplied the Food and Drug Administration with nutrient data values for raw fruits and vegetables and cooked fish in response to the Nutrition Labeling Act of 1990 that specifies voluntary nutrition labeling of the 20 most frequently consumed raw fruits and vegetables and cooked fish.

The NNDB is expanded on a continual basis to include results from new analyses conducted by industry, government, universities, and from extramural analyses funded by HNIS. Data reliability is emphasized by utilizing plans representing the national distribution of food types: (1) evaluating performance on check sample analyses during the contractor selection process; (2) requiring validated analytical methods and documented quality control procedures during contract performance; (3) promoting uniformity of procedures by encouraging cooperating among contractors, including participation in annual meetings of principal investigators; and (4) developing characterized reference materials through extramural contacts.

Emphasis is on food components believed to be important to health promotion and disease prevention. Research priorities are on filling knowledge gaps for the data base and on monitoring published data on nutrient composition of foods.

Extramural contacts continue to monitor the nutrient profiles of selected key foods in the U.S. food supply. Specialized research continues on a number of nutrients in related foods including fatty acids (including trans fatty acids), plant sterols, tocopherols (including tocotrienols), cholesterol, dietary fiber, and selenium.

• Nutrient Data base System for Large-Scale Dietary Intake Surveys

HNIS is responsible for maintaining the Survey Nutrient Data Base System for developing and documenting special data bases to assess the content of food energy and 27 nutrients in diets reported in dietary intake surveys. The Survey Nutrient Data Base System was updated to include all values needed for data analyses of the USDA 1991 Continuing Survey of Food Intakes by Health and Human Services (DHHS) National Health and Nutrition Examination Survey III (NHANES), which is currently being conducted.

The Survey Nutrient Data Base System is being expanded to include a mechanism for tracking changes to food composition values. These changes occur not only as a reflection of trends in the marketplace, but also as a result of normal data improvements. Data improvements result from increased numbers of samples as well as improved analytical technology. This expanded system will provide the ability to adjust nutrient intake estimates from surveys conducted in previous years to account for improvements in the food composition values, facilitating the analysis of trends in nutrient intakes over time.

- Revision of Agriculture Handbook No. 8, Composition of Foods...Raw, Processed and Prepared"

HNIS continued the revision and publication of major food sections for "Composition of Foods...Raw, Processed, Prepared," Agriculture Handbook No. 8 (AH-8). The section on Baked Products (AH 8-18) was revised and published in October 1992. Data are presented for 405 baked products and home-use leavening agents, expanded from 135 comparable items in the 1963 edition of AH-8. Baked products included are yeast breads and rolls, English muffins, croissants; quick breads such as biscuits, fruit breads, and muffins; cakes, cheesecakes, coffee cakes; cookies and ice cream cones; crackers, including bread sticks, crisp breads, melba toast, and matzo; doughnuts and other sweet goods; French toast, pancakes, waffles; pies and pie crusts; and corn and flour tortillas. Forms of baked products include commercial, ready-to-eat items; dry mixes; refrigerated doughs; products prepared from mixed and doughs; and products prepared from home recipes.

Data from the nationwide pork basket study on marketing practices and nutrient composition of pork and other recent research reports were evaluated and used to update fresh pork in AH-8-10. The new values show that most cooked pork loin cuts are over 30 percent lower in fat than those shown in the 1983 AH-8 section on pork products. A revised AH-8-10, "Pork Products," was recently published.

- Provisional Tables on Dietary Components

Provisional tables of food components of special interest to professionals are issued for a selected number of frequently consumed foods as reliable data become available. An updated provisional table on "The Content of Vitamin K in Selected Foods" was released. Cooperation was continued with the Human Nutrition Research Center on Aging for vitamin K analysis to generate a broad data base on key foods.

- Nutrient Data Bank Bulletin Board

The Nutrient Data Bank Bulletin Board, developed by HNIS as a public service, is available to individuals and institutions to transfer nutrient data and announcements about HNIS publications and relevant conferences directly to their own computers. This information is updated and revised monthly. The board, which operates 24 hours a day, 7 days a week, has had over 100 users per month from nearly every State, as well as some foreign countries. Release 4 of the Survey Nutrient Data Base was added to the list of data files available. Data for "Snacks and Sweets" (AH 8-19), "Baked Products" (AH 8-18), and the 1990 and 1991 Supplements were made available on the Bulletin Board and are part of the Release 10 of the Standard Reference Data Base. Other files currently on the Bulletin Board are the Dietary Analysis Program and data from Home and Garden Bulletin No. 72, "Nutritive Value of Foods"; Home Economics Research Report No. 48, "Sugar Content of Selected Foods"; and Provisional Tables on Vitamins D and K.

3. Bioavailability

- High-Fiber Diets Containing Adequate Minerals Cause No Mineral Loss

Americans are being advised to eat less fat and more fiber as a means of reducing their risks of coronary heart disease and bowel cancer. Beneficial effects from eating more fiber include decreased transit time in the bowel, reduced symptoms of diverticular disease, and with some fibers, lowered cholesterol levels or glycemic response. However, high intakes of some dietary fibers have been implicated in reducing mineral retention.
Researchers at the Beltsville Human Nutrition Research Center conducted a study where 42 men consumed a diet containing 20 percent fat/54 g fiber/2800 kcal (high-fiber diet) or 40 percent fat/29 g fiber/2800 kcal (low-fiber diet) for two 20-week periods to investigate the effects of a high-fiber diet on apparent mineral balance. Fiber added to the diet consisted of legumes, cereals, fruits, and vegetables rather than a single source.

The diet produced no significant difference in mineral parameters tested in the blood. Calcium, iron, zinc, copper, magnesium, and manganese intake and fecal excretion were significantly higher on the high-fiber diet than on the low-fiber diet. On the high-fiber diet calcium, zinc, copper, and magnesium showed significant positive apparent retention, while manganese and iron were not significantly different from a 0 balance. The data indicate that a high-fiber diet containing mineral levels at or above the recommended dietary allowance can be consumed for its potential beneficial effects without mineral loss.

- Interaction of Dietary Phytate and Calcium on Utilization of Calcium, Zinc, and Magnesium

Phytic acid is an organic phosphorous compound present in cereals and legumes. Both animal and human studies have shown that amounts of phytic acid greater than that normally consumed by most Americans will impair utilization of zinc, calcium, and magnesium when each was studied alone. Interactions between phytate and several elements are often much more difficult to ascertain.

Scientists at the Beltsville Human Nutrition Research Center investigated the effect of dietary calcium level on the impairment of zinc utilization by phytate. Eight men were given average American diets, but each meal also included two bran muffins each containing 5 g of wheat bran to elevate phytic acid intake. Three calcium intakes were studied, each for 21 days, equivalent to about 70 percent, 130 percent and 200 percent of the Recommended Dietary Allowance (RDA). The RDA for adult men is 800 mg daily. Metabolic parameters such as increased fecal excretion and lower urinary excretion indicated that dietary calcium utilization was impaired when the low-calcium diet was eaten. However, these indices indicated zinc utilization was lower when the high-calcium diet was consumed.

- Relative Bioavailability Similar for Ascorbic Acid Ingested as Fruit, Vegetables or in Synthetic Form

In order to learn more about the role of vitamin C in reducing the risk of cancer, it is necessary to know how the body uses vitamin C from fruits and vegetables. Researchers at the Beltsville Human Nutrition Research Center and the National Cancer Institute examined the blood levels of vitamin C in adult men when vitamin C was withheld for 4 weeks and again when vitamin C was replaced for 4 weeks. In the replacement period, subjects were assigned to one of four groups that received the same amount of vitamin C in the form of a tablet (with or without supplemental iron), orange juice, orange segments, or raw or cooked broccoli. The experiment was then repeated with another 4-week low-vitamin-C period and another replacement period when subjects changed groups and received a different vitamin C source.

In the first replacement period, vitamin C blood levels of all the groups were similar except for the group receiving raw broccoli, which had a 20 percent lower response. A similar pattern was seen in the second period. It was concluded that vitamin C consumed from cooked broccoli, orange juice or fruit, or a tablet is equally useful in restoring blood levels. The lower response to vitamin C from raw broccoli is not likely to significantly affect the vitamin C status of individuals who eat mixed diets.

- Bioavailability of Key Nutrients

Researchers from 10 States and the Western Human Nutrition Research Center conducted coordinated studies on the forms and amounts of bioavailable nutrients present in foods and their interaction with other nutrients and antinutrients. Selected key nutrients that are pivotal in affecting human health--calcium, iron, copper, zinc, and the vitamins folic acid, B_6, and B_{12}--were the focus.

Vitamers (compounds that perform a given vitamin activity) of B_6 and folic acid are found in foods in many forms and can now be quantified by methods developed in this project. Methods were developed to intrinsically label specific nutrients in food, including iron, calcium, copper, zinc, and molybdenum, so that nutrient metabolism could be accurately followed. Methods were also developed for studying the bioavailability of these key nutrients in humans, both in the metabolic ward and in free-living situations.

Animal models were developed as a substitute for humans so that nutrient bioavailability can be studied in a controlled and economic manner, and so that knowledge about nutrient bioavailability can continue to expand. The rat was used as a model for iron, calcium, folic acid, vitamin B_6, and vitamin B_{12}; mice and newborn pigs were used as models for various trace minerals.

Utilizing these methods, the scientists ascertained that the bioavailability of all folate vitamers in many plant and animal foods is greater than 70 percent and is relatively free of food matrix effects, while the bioavailability of several minerals and vitamin B_6 differs greatly depending on their forms in food and the presence of other food components. On the basis of these developments, it is conceivable that scientists soon may be able to list the bioavailable nutrient contents of food in food composition tables.

E. Food and Nutrition Monitoring Research

Ten-Year Comprehensive Plan for Nutrition Monitoring and Related Research

The National Nutrition Monitoring and Related Research Act of 1990 required the Federal Government to develop a Ten-Year Comprehensive Plan for Nutrition Monitoring and Related Research. A Joint USDA-DHHS Working Group assisted in developing the draft plan published in the Federal Register for public comment in late 1991. The 53 public comments were reviewed and the draft Plan was revised and finalized. As required by law, the President transmitted the final Plan to Congress. It will also be published in the Federal Register. The Ten-Year Plan serves as the basis for planning and coordinating the activities of 22 Federal agencies responsible for nutrition monitoring and/or related research activities. The primary goals of the Plan are to ensure that the agencies participating in the National Nutrition Monitoring and Related Research Program collect data that are continuous, timely, and reliable; coordinate data collection with other member agencies; use comparable methods for data collection and reporting of results; and conduct research on the issues and topics relevant to monitoring the nutrition and health status of the population and subgroups at nutritional risk. The Plan identifies nearly 70 activities to complement or expand nutrition monitoring and related research. The 1992 Ten-Year Comprehensive Plan: Approach and Progress Document was developed to assess progress made in 1992 toward implementing the activities of the Plan.

1. U.S. Food and Nutrient Supplies

• Nutrient Content of the U.S. Food Supply

Food supply determinations are one of five components of the National Nutrition Monitoring system. The USDA Economic Research Service (ERS) determines the amounts of food available for consumption annually in the United States. Foods are at a preprocessed or commodity level when per capita use is determined. HNIS estimates per capita per day levels of food energy and 24 nutrients and food components in the U.S. food supply. Estimates of the nutrient content of the food supply are derived by using data on quantities of foods available for consumption and data on the nutrient composition of foods. Because estimates are based on food disappearance data, nutrient levels represent what is available for consumption, rather than actual nutrient intake by individuals. The nutrient content of the U.S. food supply series dates continuously from 1909. A departmental report entitled "Nutrient Content of the U.S. Food Supply for the years 1909-1988" (HERR No. 50), which includes a discussion of methodological procedures and trends in food and nutrient levels along with tables of nutrient per capita levels, was published in 1992. This report updates the previous administrative report and also contains a more thorough discussion of procedures and results. A factsheet describing the food supply also was revised.

• Food Disappearance

ERS annually estimates the amount of food available for human consumption in the United States. This historical series is the only source of time-series data on the supply of food available for consumption in this country. These estimates are derived from calculating the total supply of a given commodity and subtracting exports and nonfood uses. More precisely, the data estimate disappearance of food into the marketing system. Hence, they are often referred to as "food disappearance."

Total supply is obtained by adding imports and beginning stocks to production. This figure, minus exports, shipments to the U.S. territories, livestock feed, seed requirements, nonfood industrial use, and yearend stocks, yields food disappearance. The per capita supply is calculated by dividing total annual disappearance by the July 1, U.S. population, including the Armed Forces overseas. Following are some highlights of changes in per capita food supplies between 1970 and 1991.

In 1991, Americans used an average of 112 pounds of red meat, 58 pounds of poultry, and 15 pounds of fish and shellfish (equivalent boneless) per capita. That's 20 pounds less red meat, 24 pounds more poultry, and 3 pounds more seafood per capita than in 1970. Annual per capita use of eggs declined 25 percent between 1970 and 1991, from 309 eggs to 231. The aging of the baby boomers brought a 5.5-gallon decline since 1970 in annual per capita use of beverage milk to 25.7 gallons in 1990. Per capita use of soft drinks increased 75 percent during the same period, to 42.5 gallons in 1990, and per capita use of beer increased 30 percent, to 24 gallons. The trend toward lower fat milk was pronounced: In 1970, per capita use was 25.4 gallons of whole milk and 5.8 gallons of lowfat and skim: By 1990, it was 10.5 gallons of whole milk and 15.2 gallons of lowfat and skim. However, Americans used 1 percent more milkfat per person in 1990 than in 1970 because of their yen for cheese (per capita use rose 13.3 pounds during 1970-90, to 24.7 pounds) and cream products (per capita use rose 2.2 pounds, to 7.1 pounds). Growing interest in healthy eating and convenience, significant growth in in-store and retail bakeries, the mainstreaming of ethnic foods, and a host of new products spurred a 36-percent increase in annual per capita use of flour and cereal products from 1970 to 1990. Per capita use of fresh potatoes declined 26 percent from 1970 to 1990, as consumption of frozen potatoes nearly doubled, to 25 pounds per person (retail weight) in 1990. 1990 was the first year in which, on a farm-weight basis, use of potatoes for freezing surpassed fresh market use. In contrast, total per capita use of 16 other major commercial fresh vegetables in 1990 was 25 percent above the 1970 level. Fresh fruit use gained similarly. Total per capita use of caloric sweeteners increased 18 pounds (dry basis), or 15 percent, during 1970-91, from 121 pounds to 139 pounds. By 1991, low-calorie use was about 24 pounds per person in sugar-sweetness equivalent, accounting for about 15 percent of overall sweetener use, compared with 5 percent in 1970.

For more complete information on ERS' food supply series, see Food Consumption, Prices, and Expenditures, 1970-90 (SB-840, 148 pp., August 1992).

2. Food Consumption Surveys

• Changes in Food Consumption and Expenditures in American Households During the 1980's

The consumption of dairy products, fats and oils, flours and cereals, bakery products, meats, eggs, sugars and sweets, and fresh vegetables, on an annual per person basis, fell during the 1980's. The consumption of poultry, fish and shellfish, juices, and beverages rose, while fresh fruits stayed about the same. Per person spending when adjusted for inflation, on the other hand, declined for almost all major food groups. Exceptions were flour and cereals, led by increased spending for breakfast cereals, poultry, and beverages. These aggregate national trends mask the fact that, for some demographic groups, consumption ran counter to national trends. For example, in 1987-88, poorer households consumed considerably fewer fresh vegetables than wealthier households, but ate more meats than the wealthy.

Changes in Food Consumption and Expenditures in American Households During the 1980's (by Steven M. Lutz, David M. Smallwood, and James R. Blaylock of ERS, and Mary Y. Hama of HNIS, SB-849, 94 pp., December 1992) presents information on the quantity and dollar value of food consumption in American households for 1977-78 and 1987-88 by selected socioeconomic and demographic characteristics. The major changes over the decade are tabulated for 64 major food groups and compared with other studies to gain further insights into possible explanations for the consumption shifts. Data are from the household component of the 1977-78 and 1987-88 Nationwide Food Consumption Surveys (NFCS) conducted by HNIS. The tabulations are based on actual reported usage of foods from home food supplies with adjustments for meals eaten away from home. Due to the possibility of sampling bias associated with low response rates in the 1987-88 NFCS, it is recommended that these findings be verified with other data sources before making definitive claims of changes in household consumption behavior.

Other highlights:

Household Size: Per person consumption tends to decline for almost all commodities as household size increases. This is because larger households contain more children who tend to consume less than adults. Several exceptions to this include: fresh fluid milk, flours and cereals, and sugars, all of which tend to be used heavily by children. Aside from the overall changes, trends observed across households of different sizes in the 1977-78 data are similar in the 1987-88 data. However, smaller households had larger proportional decreases in the consumption of eggs and sugars and sweets than did larger households. Larger households had a greater proportional increase in the consumption of vegetable and fruit juices than did smaller households. Per person spending also tends to decline as household size increases because larger households can take advantage of economies of size, such as buying in bulk.

Household Type: During 1987-88, households headed by a single female with children consumed fewer dairy products, fats and oils, bakery products, fresh fruits and vegetables, and beverages per person than did other types of households. These households ate more flours and cereals, meat, sugars and sweets, and canned fruits and vegetables. Many of these trends are probably caused by the fact that single females with children have significantly less income, about half that recorded for other households. Between 1977-78 and 1987-88, female-headed households increased per person consumption of vegetable and fruit juices, and other types of beverages, and decreased consumption for most other commodity groups. Single females with children also ate about the same amount of poultry, fish, and shellfish per person, while other types of households substantially increased their consumption of these foods. Female-headed households used less fresh fruits between 1977-78 and 1987-88, while other households ate about the same. Female-headed households usually spent less per person than other types of households on most commodity groups.

Income Quintile: In 1987-88, per person consumption of dairy and bakery products, poultry, fish and shellfish, fresh fruits and vegetables, juices, and beverages generally increased as a household's income rose. But, consumption of flours and cereals, meats (especially pork and lunch meats), eggs, sugars and sweets, and canned fruits and vegetables declined as income increased. One particularly interesting change between 1977-78 and 1987-88 was in the meat group. In 1977-78, meat quantities consumed rose with income, but the opposite was found in the 1987-88 survey. The decline in beef consumption was particularly steep for all income groups. Except for eggs and canned fruits and vegetables, per person spending on all other food groups rose as income increased.

Race: In 1987-88, European-American households consumed more dairy products, fats and oils, bakery products, fresh fruits and vegetables, and beverages per person than did African-American households. On the other hand, African-Americans consumed more flour and cereals, meats, poultry, and fish than did their European-American counterparts. Households headed by neither a European-American nor an African-American consumed more flour and cereals and fresh vegetables, but less sugars and sweets and canned and frozen fruits and vegetables than did other race groups. Most of these tendencies also occurred in 1977-78. One exception was that African-American households consumed about the same amount of sugars and sweets, while other races consumed less than they did in 1977-78. Also during the 1980's, households headed by neither a European-American nor an African-American overtook their European-American counterparts as the largest per person consumer of fresh vegetables. African-American households spent less per person on virtually all food groups except meat.

Region: There were large differences in the consumption patterns of households across regions. Many of these differences can be explained by price variations, income differences, and racial composition. In 1987-88, residents of the Midwest consumed the most dairy products and southerners the least. Westerners were the largest consumers of fresh fruits and vegetables (excluding potatoes). Northeasterners led in the consumption of poultry and fish, frozen fruits and vegetables, and juices. Southerners consumed the most fats and oils, flour and cereals, meats, sugars and sweets, and canned fruits and vegetables. Some dramatic consumption changes occurred within regions between the two surveys. For example, beverage consumption by southerners increased from about 182 pounds per person in 1977-78 to about 269 pounds in 1987-88. Beef consumption dropped by about 30 pounds per person in the Northeast. There was as much variation, if not more, across regions in terms of per person food expenditures as there was for consumption, suggesting that regional price differences are a determining factor in food choice and expenditure decisions.

Urbanization: Suburbanites led the way in consuming dairy products, fresh fruits and vegetables, and beverages, according to the 1987-88 data. People in nonmetropolitan areas consumed the most fats and oils, meats, sugars and sweets, and canned fruits and vegetables. Central city residents are the Nation's largest consumers of poultry and fish. Among the three levels of urbanization (central cities, suburban areas, and nonmetropolitan areas), the consumption patterns of central city and suburban residents appear to be more similar. Changes in consumption during the 1980's, when depicted by urbanization level, were generally similar to those of the overall population. Americans in suburban areas increased their consumption of fresh fruits, while those in other areas decreased their consumption. Like consumption, per person expenditures on the various commodity groups tended to vary considerably across urbanizations.

3. Nationwide Food Surveys

a. Collecting and Reporting of Nationwide Survey Data (HNIS)

Nationwide Food Surveys (NFS) is an umbrella term for several different types of surveys conducted by the Human Nutrition Information Service. During 1992 work continued on four different but concurrent nationwide surveys each in a different stage of the survey process. Survey activities continued in the following areas: (1) completing the release of data from the 1987-88 Nationwide Food Consumption Survey (NFCS); (2) release of data tapes and preparing reports for publication from the 1989 Continuing Survey of Food Intakes by Individuals (CSFII) and the Diet and Health Knowledge Survey (DHKS); (3) monitoring contractor performance and processing of data for the 1990 and 1991 CSFII and DHKS surveys; (4) developing a Request for Proposals for the 1994-96 CSFII and DHKS, evaluating proposals, awarding a contract, and monitoring contractor performance; (5) planning for the Household Food Consumption Survey (HFCS) to be conducted in 1996; and (6) conducting other research activities that are part of the National Nutrition Monitoring and Related Research Program.

• Continuing Survey of Food Intakes by Individuals

CSFII measures the kinds and amounts of food eaten by Americans. It addresses the requirements of the National Nutrition Monitoring and Related Research Act of 1990 for continuous monitoring of the dietary status of the U.S. population, including the low-income population.

The development of CSFII 1994-96 is in direct response to Congress' request that HNIS improve methodology and contracting procedures and enhance survey data quality. During 1992 HNIS worked with the Bureau of the Census Demographic Surveys Division (DSD) and Center for Survey Methods Research (CSMR) and the Continuing Survey Users Group (CSUG) to develop CSFII 1994-96. DSD staff are knowledgeable in survey planning, costing and management. CSMR staff have expertise in questionnaire development based on the conduct of cognitive research. HNIS created CSUG as a vehicle to incorporate other federal agencies' input. These agencies are members of the National Nutrition Monitoring Program and users of CSFII data: Food and Nutrition Service, Food Safety and Inspection Service, Agricultural Research Service, National Cancer Institute, National Center of Health Statistics, National Marine Fisheries Service, Food and Drug Administration, Economic Research Service, National Heart, Lung, and Blood Institute, Environmental Protection Agency, Cooperative State Research Service, Extension, and the Bureau of the Census.

HNIS and DSD worked together on the development of a Request for Proposals (RFP) and an Independent Government Cost Estimate (IGCE). Both the RFP and EGCE emphasize high response rates, improved survey management, extensive quality controls and reduced respondent burden. In September, 1992, a fixed-price contract was awarded to Westat, Inc. and for the first time the contract includes: specific sampling requirements in order to achieve a nationally representative sample; response rate requirements with penalties assessed if they are not met; and specific staffing requirements to insure adequate survey management and quality control throughout the life of the contract.

HNIS worked with CSUG and CSMR on the development of the survey questionnaire. HNIS solicited input from CSUG members on the review of existing questions and on the revision, omission or addition of questions. CSMR conducted research on enhancing respondents' cognitive abilities to recall their dietary intake and reducing respondent burden.

A pilot study of the data collection methods and all survey operations will be made before data collection for the full survey. A computerized system for online coding and entry of food intake data will be introduced in the CSFII 1994. The target population will consist of noninstitutionalized individuals in all 50 States; previous surveys have included only 48 States. The total number of CSFII respondents is anticipated to be about 16,000 individuals over 3 years. A subset of about 45 percent of the sample will consist of individuals from low-income households.

- Diet and Health Knowledge Survey

In 1989, a new type of survey was initiated to assess, on a continuous basis, knowledge and attitudes about dietary guidance, food labeling, and food safety. It is called the Diet and Health Knowledge Survey (DHKS) and is conducted as a telephone follow-up to the CSFII. This annual survey adds to existing data available for understanding factors that affect food choices. It contributes information needed for developing and targeting nutrition education materials and programs. Data collection for 1989-91 has been completed and the data tape for the 1989 survey has been released. Collection of DHKS data in 1994-96 is included in the contract for the CSFII 1994-96. A technical report on nutrition attitudes and dietary intakes is in preparation.

- Household Food Consumption Survey

Planning for this survey to be conducted in 1996 is underway. The Census Bureau has been asked to conduct the survey. A pretest will be conducted in 1994. The survey will include the collection of information on foods used by households during a 7-day period and the cost of those foods. Data from this survey will be used to update the Thrifty Food Plan which is the statutory basis for the Food Stamp Program.

- Nationwide Food Consumption Survey 1987-88

The 1987-88 NFCS, the seventh nationwide survey on food consumption, included two components: a household component which included detailed information on the food used by the entire household during a 7-day period and the cost of that food and an individual component which included the food eaten at home and away by each household member over a 3-day period. Data tape release of information from NFCS was completed in 1992 with the release of data and documentation on low-income households. In addition, a report on food and nutrient intakes has been sent for publication. Work continues on a report on household food consumption and dietary levels. Sample selection, data collection, and data processing were conducted under contract by National Analysts. The data collection began in April 1987 and was completed in August 1988. The NFCS had a very low response rate—38% at the household level and 31% at the individual level and was the subject of an investigation by the General Accounting Office. HNIS conducted numerous statistical analyses to explore the impact of the nonresponse on estimates of food and nutrient intakes.

- Survey Net

Survey Net is a new computerized network system developed by HNIS to enhance survey operations management. This PC network was designed for two purposes: (1) to provide an efficient State-of-the-art system that survey contractors can use for coding dietary recall and food intake records; and (2) to provide automated procedures for HNIS to efficiently update the food code system and to monitor and measure quality of a contractor's performance. The coding process, including the contractor's communications with HNIS to solve coding problems, is the most time-consuming part of a survey. The new system will streamline this process, and problems can be transferred electronically to HNIS for resolution. The system will permit HNIS to have a direct link to the coding process, to continually monitor the quality of survey data as it is collected, and to generate the periodic reports measuring actual performance of coders and supervisors against HNIS expectations. Indirect measurements of interviewer performance can also be made through this system. The new system was tested and evaluated by HNIS in 1992 and will be ready to operate in a production environment for the next series of the Continuing Survey of Food Intakes by Individuals.

- Food Grouping System

During 1992, work continued on the specifications and use of the Food Grouping System (FGS), and HNIS received technical and procurement approvals for development of an automated FGS. The objective of the FGS is to expedite analysis of food consumption data as reported in national surveys of food consumption by individuals (e.g., NFCS, NHANES) in terms of ingredients or agricultural commodities. The FGS is being developed with the cooperation of the Environmental Protection Agency (EPA) and the Food and Drug Administration (FDA). In addition, it is a major component of the USDA Pesticide Data Program (PDP), a comprehensive, multi-agency program to provide actual residue and use data to help form the basis for conducting realistic risk assessments and setting pesticide tolerances. Data generated by the FGS will be available to EPA and FDA for use in their Dietary Residue Exposure System and Total Diet Study, respectively.

b. Research on Determinants of Dietary Status and Survey Methods

- Plasma Carotenoid Levels Correlated With Dietary Intake

A newly available data base that provides carotenoid values for more than 2,300 foods was linked to dietary data on 57 male nonsmokers in order to examine the association between dietary carotenoid intake and plasma carotenoid levels. For the first time, researchers at the Beltsville Human Nutrition Research Center were able to assess dietary carotenoid intake based on the individual carotenoid values of specific foods. Carotenoid intake was estimated from a food-frequency questionnaire, and 7 days of food diaries and blood samples. Using food frequency questionnaires, adjusted diet-plasma correlations for five individual carotenoids ranged from r = 0.20 to r = 0.46. Diet-plasma correlations based on food diaries were positive and statistically significant. Both types of dietary assessment led to modest diet-plasma correlations for the individual carotenoids, which might reflect high variability within and between individuals in intake and plasma levels.

• Comparison of Micronutrient Intake Measured by a Dietary Questionnaire and Biochemical Status Indicators

Studies of the role of micronutrients in the etiology of diseases such as cancer and heart disease usually include hundreds, if not thousands, of subjects. Because of the expense and difficulty of collecting and analyzing repeated blood samples or multiple-day diet records of free-living subjects, investigators must rely on simple and inexpensive methods to assess nutrient intake; one such method is the food frequency questionnaire. Because the benefits are inconsequential if the method does not adequately measure nutrient intake, researchers at the Human Nutrition Research Center on Aging determined the appropriateness of the food frequency questionnaire in estimating micronutrient intake. The intakes of 12 micronutrients as reported on a semiquantitative food frequency questionnaire were compared with corresponding biochemical indicators of nutrient status in a sample of 57 men and 82 women ages 40-83. Biochemical measures of thiamin, vitamin A, and zinc did not correlate with the food-frequency-reported intakes of these nutrients. Biochemical measures and intakes did correlate strongly for carotenoids, vitamin D, vitamin E, vitamin B_{12}, folate, and vitamin C. These results demonstrate that both food frequency questionnaires and biochemical measures can provide useful information about the intake of micronutrients.

• Cross-Cultural Differences in Nutrient Intake

Cross-cultural relationships between dietary intake and cholesterol-carrying particles in the blood stream were assessed, with a focus on plasma triglycerides and levels of cholesterol in low-density lipoproteins (LDL's) and high-density lipoproteins (HDL's). Elevated LDL cholesterol values have been associated with an increased risk of heart disease, and increased levels of HDL cholesterol have been associated with decreased risk.

Scientists at the Human Nutrition Research Center on Aging studied nutrient intake, plasma lipoproteins, apolipoproteins (apo), and LDL particle size in rural and urban Costa Rican populations and participants in the Framingham (MA) Heart Study. Intakes of protein and animal fat were higher among urban than rural Costa Ricans and still higher in Framingham residents. No major differences in intake were found in dietary cholesterol. However, saturated fat intake was lowest in rural Costa Ricans, higher in urban Costa Ricans, and highest in the Framingham residents. Total cholesterol and LDL cholesterol levels were significantly higher in Framingham residents than in subjects in Costa Rica. Subjects in Costa Rica were more likely to have elevated triglyceride and apo-B levels, low HDL cholesterol and apo A-1 levels, and smaller LDL particle size. Cross-cultural differences may be due to differences in dietary intake and physical activity, as well as to differences in ethnic background.

• Diet May Not Provide Adequate Amounts of Calcium, Iron, Magnesium, and Zinc in Well-Educated Adult Populations

Researchers at the Beltsville Human Nutrition Research Center evaluated mineral intakes from diet alone and diet plus supplements in 322 men and 242 women ages 20-95 to see if the diets of free-living adults provided adequate amounts of calcium, iron, magnesium, and zinc. Age groups were compared to see if older Americans were at greater risk than younger people. Seven-day diet records were used to assess intake, and an intake of less than two-thirds of the Recommended Dietary Allowance was considered inadequate.

Women were more likely than men to have inadequate dietary intakes of all minerals, but they also were more likely to take supplements. Young women were at risk for iron deficiency. Calcium intake was lower in older women. Those taking supplements of calcium, iron, and magnesium had diets higher in these minerals than those who did not take supplements. The diets of substantial numbers of men and women were inadequate in zinc regardless of supplementation. The results show that substantial numbers of Americans do not receive adequate amounts of some minerals from diet alone. Any health consequences could not be determined from the study.

• Model To Correct Altered Intake Due to Study Interventions

Being in a study of food consumption causes people to eat differently than they do when not being observed. Methods that measure nutrient intake do not correct for changes in food intake during study collection periods. Most subjects eat less than usual when they are completing diet records or collecting duplicate diet samples (for each meal eaten a duplicate meal is served for analysis). Researchers at the Beltsville Human Nutrition Research Center conducted a study to correct the nutrient intake from altered food intake due to the study. Derived nutrient intake was determined by multiplying the measured nutrient density of duplicate diet samples times the actual energy (calorie) requirement. The derived nutrient intake of chromium, copper, iron, manganese, zinc, calcium, and magnesium in men was in excess of the Recommended Dietary Allowance (RDA) or suggested safe and adequate intake. The derived calcium intake was above the RDA for females over 19. Derived intakes for copper, iron, and magnesium were above 70 percent of the

RDA or suggested safe and adequate intake and for chromium was 57 percent of the RDA, the lowest level of the nutrients tested in both men and women.

F. Government Policies and Socioeconomic Factors

- Breastfeeding Prevalence and Duration--1988 National Maternal and Infant Health Survey

The study employs descriptive and multivariate statistical techniques to model the determinants of breastfeeding initiation and duration among prenatal WIC participants and nonparticipants using cross-sectional data from the 1988 National Maternal and Infant Health Survey. The study explicitly corrects for unmeasured differences between WIC participants and income-eligible nonparticipants (usually referred to as selection bias), in addition to controlling for other socioeconomic and demographic factors that are frequently found to be associated with breastfeeding, including mothers' and fathers' ages, education, race, and family income. Although the study is cross-sectional in design and cannot identify causal relationships, the resulting analysis of breastfeeding patterns among WIC participants and other population groups may provide interesting hypotheses for future research. The final product, "The WIC Breast Feeding Report," was released in September 1992.

- Child Nutrition Program Operations: On-Site Meal Observation Substudy

This study examined the food and nutrient composition of NSLP and SBP meals at three levels: (1) as offered by participating schools; (2) as selected by participating students; and (3) as actually consumed by participating students. At each level, the total nutrient content of an average meal was compared to the Recommended Dietary Allowances for essential nutrients. The fat, cholesterol, and sodium content of meals was also examined. Data collection occurred in the spring of 1990 in a total of 60 schools in 20 school districts. The report was released in June 1992.

- Menu Modification Demonstrations

FNS awarded 3-year grants to five school food authorities to conduct menu modification demonstration projects. These sites will demonstrate local-level efforts to improve the nutrient content of meals served, particularly in the areas of reducing fat and sodium. During the 1990-91 and 1992-92 school years, grantees implemented recipe, food specification, and food preparation modifications to meet their individual fat and sodium content goals. The sites also developed various nutrition education and project promotion activities to complement the menu changes. An independent evaluation is being conducted and data collection includes nutrient analysis of menus, plate waste measures, and 24-hour dietary recalls. The final report is expected in summer 1993.

- Evaluation of the Alabama Pure Cash-Out Demonstration, Evaluation of the San Diego Cash-Out Demonstration, and Evaluation of the Washington State Family Independence Program

The major focus of these three evaluations is on the effects of issuing food benefits in the form of cash on recipient household expenditures, food expenditures, food use, and nutritional availability. Reports for Alabama and San Diego were released in 1992.

- Study of WIC Participant and Program Characteristics

Public Law 99-500, enacted in 1986, requires FNS to submit a biennial report to Congress on income and nutritional risk characteristics of participants. To satisfy this requirement, FNS developed and implemented a system of gathering, analyzing, and publishing WIC Program information. The information includes periodic descriptions of the characteristics of State and local agencies which operate the program as well as the characteristics of individuals and families participating in the program. Data for the 1992 report, now being finalized, was gathered from a census of participants for approximately 20 data elements directly generated from ongoing management information systems serving the WIC Program.

- WIC Child Impact Study Field Test

The purpose of this study was twofold: (1) to simultaneously field test two research designs which were intended to examine the impact of the WIC Program on the health and development of infants and children; and (2) to collect preliminary data on the effects of WIC on children. The study also included field testing the data collection measures and procedures proposed in the two research designs. The contract for this study was awarded in September 1989 and the final report was released by FNS in March 1992. The full-scale WIC Child Impact Study was cancelled in response to a Congressional directive.

- CDC-FNS Cooperative Project on Smoking Cessation in Pregnancy

A cooperative agreement with the Centers for Disease Control (CDC) extended its Smoking Cessation in Pregnancy (SCIP) Project to include coverage of WIC sites. Pilot projects for intervening in smoking behavior in WIC and prenatal care settings operated in Colorado, Missouri, and Maryland. The major objectives of this project were to: develop, field test, and evaluate a package of smoking interventions for use with WIC participants which is compatible with both prenatal clinic and WIC program settings; and develop a practitioners's guide for adapting and implementing prenatal smoking cessation efforts for WIC participants in non-study sites. Although the study has been completed, the evaluation will continue for quite some time.

- Very Low Birthweight Among Medicaid Newborns in Five States: The Effects of Prenatal WIC Participation

A new report extends the original WIC Medicaid analysis by examining whether participation in WIC is also associated with a decrease in the incidence of very low birthweight (that is, birthweight less than 1,500 grams). The study found that WIC participation was associated with a significantly lower incidence of very low birthweight, and corresponding savings in Medicaid costs. The estimated reductions in the prevalence of very low birthweight attributable to WIC ranged from 27 percent in Florida to 55 percent in South Carolina, with intermediate values of 39 percent in Texas and 45 percent in North Carolina. On average, States saved $12,093 to $15,385 for each very-low-weight birth prevented.

- Feeding Young Children in Group Settings

More than 2.5 million children in the United States are enrolled in child care facilities outside the home and eat at least one meal per day within these facilities. It is common practice to feed children predetermined amounts, based on serving sizes recommended by the guidelines for the Child Care Food Program (CCFP). However, concern has been expressed about limiting children's intake. A 3-year study in the Child Development Laboratory at the University of Idaho compared food intake and plate waste of preschool children during snack time. Children in the control group were fed a predetermined amount of snack based on the CCFP guidelines. Children in the satiety group were allowed to eat until satisfied. Mean intake of the satiety group (1.8 portions) was significantly higher than the control group (1.1 portions), suggesting present recommended portion sizes are too small for most young children. Intake of the children in the satiety group varied from day to day, with no one child consistently eating more than the others. The satiety group wasted significantly less food than the control group. Results indicate that preschool age children in child care facilities should be allowed to eat to satiety to prevent hunger and decrease food waste.

- Consumption Patterns of Single-Parent and Two-Parent Families Differ Significantly

The percentage of single-parent households rose from 13 percent in 1960 to 21 percent in 1989. The ARS Family Economics Research Group analyzed data from the 1989 Consumer Expenditure Survey to compare the expenditures of single-parent families with those of two-parent families. The results show that with the exception of shelter (food, clothing, healthcare, etc.) the two groups differed significantly in their consumption patterns. Such findings have implications for public policymakers, family resource management professionals, and marketing planners.

- Health Care Trends

The future direction of health care in the United States was reviewed by the ARS Family Economics Research Group. Out-of-pocket costs to individuals and families, as well as costs paid from public funds, continue to increase rapidly. Although sophisticated medical computer technology can be used to help diagnose, prognosticate, and evaluate treatments, its widespread use has added significantly to health care costs. Despite the large amount of money allocated to health care, the needs of many Americans are not being met, including the elderly who need long-term care, AIDS patients, the uninsured, and the underinsured. Recent developments that can help Americans with their health care needs include the establishment of State and community ombudsmen to assist families with nursing home problems, the advent of long-term-care insurance, and the creation of Older Americans Independence Centers.

- Meeting Basic Needs: Food, Housing, and Clothing Concerns of Rural Southern Elders

The ability to meet food, housing, and clothing needs may be influenced by the resources that elders have available to them, along with their concern in filling basic needs. Data from the regional research project "Quality of Well-Being of the Rural Southern Elderly: Food, Clothing, and Housing" were used by the Family Economics Research Group to describe the characteristics of elders who said these basic needs were concerns. Results show that higher percentages of study participants in all socioeconomic categories said food (43-61 percent) and housing (26-41 percent) were greater concerns than clothing was (less than 11 percent). Findings regarding the concerns of rural southern elders will be useful to family caregivers, community organizations, and social service agencies that assist elders.

• Economic Status of Families With Children in Rural and Urban Areas

The economic well-being of families with children is of concern to policymakers and family professionals. Using the 1989-90 Consumer Expenditure Survey, the Family Economics Research Group found that married couples with young children in urban areas had before-tax incomes 55 percent higher than their rural counterparts ($40,785 versus $26,376). Thirty-one percent of rural families with young children resided in a mobile home. The before-tax income of female-headed, single-parent families in rural areas averaged $14,802, whereas that of their urban counterparts was 10 percent higher at $16,237. A larger proportion of urban single parents had children born out of wedlock and were less educated. Results suggest that programs targeted to single-parent families should be tailored to the distinct groups in each area.

• Changes in the Economic Status of America's Elders During the Past 50 Years

The Family Economics Research Group reviewed the changes in economic status of elders over the past 50 years. Findings show increases in income and wealth with a concurrent decline in poverty rates; these trends are primarily the results of public policy and programs including Social Security and Medicare. Data from consumer expenditure surveys show elders allocating a decreasing share of their money to food and apparel over the past 50 years. Shares have increased for housing, transportation, and health expenditures.

G. Food and Nutrition Information and Education Research

1. Establishing Dietary Guidance Policy

• Relationships of Nutritional Knowledge, Attitudes, and Beliefs to Dietary Behaviors and Nutrient Intake

A study by HNIS in cooperation with the University of North Carolina is underway to identify determinants of knowledge and attitudes towards the Dietary Guidelines for Americans and to assess their effect on dietary status. Data from the 1989 Diet and Health Knowledge Survey are being used. Preliminary results indicate that a significant proportion of the population reports an awareness of the relation of diet to health problems; levels of awareness are lower in the low- income sample. However, many respondents incorrectly reported awareness of diet-disease associations which may not exist (e.g., cholesterol and hypertension). The research will identify knowledge/attitude differences across age, income, education, and race/ethnic groups to improve understanding of factors affecting dietary status and improve ability to target interventions.

• The Dietary Change Research Model

Research using the Dietary Change Research Model (DCRM) has continued. The mathematical model measures the change required in food consumption patterns of Americans to meet specified nutritional recommendations. Professionals can use information from the model to gain insight into strategies for implementing these nutritional recommendations. In a recent study, the changes needed in diets of adult women to meet the 1989 Recommended Dietary Allowances and other recommendations from the National Research Council were assessed. For example, the computer-generated DCRM pattern showed more low-fat red meat, and much less lunch meat and franks than in actual consumption patterns. However, the model did not increase poultry and fish as much as anticipated. The direction indicated by the model helps nutrition educators to understand the balance between types of red meat and poultry and fish in meeting the competing need to increase zinc and decrease fat. The switch by the model to lower fat red meats is to provide more zinc while limiting saturated fat. Although fish and poultry are low in saturated fat, an increase in poultry and fish would have provided less zinc than did the increase in red meats. This type of information is important in formulating dietary recommendations, which can be realistically met from today's food supply.

• Research Base for the USDA Food Guide

Release of the Food Guide Pyramid, which illustrates the Food Guide developed by HNIS in the early 1980's, generated considerable interest in the research on which the Food Guide is based. Several reports detailing the philosophical goals and the scientific basis for USDA's Food Guide were completed and released. These reports update earlier reports on the Food Guide. New Recommended Dietary Allowances, Dietary Guidelines, and food composition data were used in analyses to document that diets planned according to the Guide provide adequate amounts of essential vitamins and minerals without excesses of food components linked to chronic diseases.

• Research on Analytical Methodology

To formulate effective dietary guidance, HNIS studies the extent to which Americans are currently following dietary recommendations and the factors that influence their dietary status. Data on food consumption from USDA's and DHHS's surveys and data on knowledge and attitudes toward diet and health from surveys conducted by USDA and FDA are used in research projects. Various methods of analyzing data are studied. For example, the effectiveness of using a graphic representation of individuals' nutrient intakes to facilitate presentation of diet assessments was examined. The graphic technique used, known as Chernoff's faces, is innovative in that it represents multivariate data (such as intake data for a variety of nutrients) in a concise, easily comprehensible format that provides an overall summary of the data while preserving information on the values of individual variables. Results indicate that the graphics could facilitate assessment of overall diet quality and are potentially useful as a tool for analysis of diet quality of population groups. Work continued on the development of an analytical research tool, called the Food Grouping System (FGS), which will allow data on intake of food mixtures to be separated into discrete ingredients and regrouped as desired for further analysis. This tool will help assess the compliance of the population with dietary recommendations.

- Dietary Patterns: Implications for Nutrition Education

Cooperative research was continued with the University of North Carolina, Chapel Hill, NC, on the relationship between patterns of eating at home and away and several alternate measures of dietary status. One major finding was a rise in the proportion of individuals who consumed substantial portions of their daily calorie intake at fast food locations in 1987-88 compared to 1977-78. While overall mean fat intakes of men and women declined between 1977 and 1987, only small decreases in fat intake were found in the diets of individuals in the "fast food" pattern.

- Food (In)Sufficiency Status

Two research projects were completed by HNIS and FNS and published in professional journals. One provided evidence that food consumption surveys could be used to assess the food insufficiency status of participating households, on average. By asking the survey respondent to describe the household food supply as providing enough of the kinds of foods they wanted to eat, enough but not always the kinds of foods they wanted to eat, or not enough to eat. This assessment of the household food supply is subjective and different from measures of "clinical" hunger. The other study concluded that women ages 19-50 years who reported not having enough food to eat had, in general, lower average food and nutrient intakes than those who reported enough to eat. However, this difference was generally not as strong for their children ages 1-5. This may indicate that women ensure that the children receive the nutrients they need by giving up food themselves.

- Children's Diets

A project to combine information from several sources on the dietary status of children was completed by HNIS, and a report was drafted summarizing the findings and presented at the Sixth Annual Food Policy Roundtable sponsored by Public Voice for Food and Health Policy and the Food Marketing Institute. Among major findings were that, on average, teenagers' diets were low in six nutrients (as compared to the RDA) and exceeded recommended intakes of fat; only 50 percent of teenagers reported any fruit intake on a given day. The recommended amount is 2 to 4 servings of fruit per day. Among teenage females on a given day, 4 in 10 reported no fluid milk, 1 in 4 reported no servings of any vegetables, and 9 in 10 reported no dark green vegetables. Between 1977-78 and 1987-88, milk consumption declined and soft drink consumption increased among all teenagers so that the average intake of soft drinks equaled the intake of fluid milk.

- Great Beginnings: Multifaceted Nutrition Education Program Evaluation

The University of New Hampshire Cooperative Extension has developed a nutrition education program called Great Beginnings, which is designed especially for pregnant adolescents and young mothers who participate in the WIC program. This program was partially funded by and developed in cooperation with FNS; ERS is assisting in developing and implementing an evaluation process.

The analysis will develop a model for evaluating the Great Beginnings program based on nutrition knowledge, diet quality, and selected anthropometric/health measures of the targeted individual and her infant. The evaluation will attempt to control for such outside forces as income, education of family, urbanization, etc. that are known to interact with and influence the participant.

The Great Beginnings program is an excellent example of many of the intensive education programs targeted to high-risk groups. The evaluation will examine not only the short-term linkages from education to knowledge to behavior change, but the long-term linkage to real health outcomes as well.

- Food Safety Concerns/Nutrition Concerns

A research project investigating the characteristics of households with high levels of food safety concern was initiated. A report is in the draft stage. Among the major findings were that characteristics associated with lower levels of food safety concern were higher education levels of the male head of household (when present), outside employment of the female head of household (when present), and being in a household headed by a male only. African-Americans had higher levels of food safety concerns than European-Americans, other things being equal.

- Is the Population Following Recommendations on Vegetable Intake?

This question was assessed using food consumption data from USDA's surveys and partially completed files and procedures from the Food Grouping System (FGS). Use of the FGS, an analytical system which has been in development for several years, allowed for the first time reporting of total vegetable consumption from all food mixtures and exclusion of non-vegetable ingredients from vegetable products. Results indicated that, on average, individuals consumed about 2-1/2 to 2-3/4 servings of vegetables per day. This was below the recommendation of 3-5 servings per day. Results from this analysis were presented at two meetings and will be used published. In addition to nutrition educators, data such as these on the total intake of specific commodities are of interest to the EPA and the FDA, which are concerned about exposure to pesticides and other food safety issues.

- Economic and Sociodemographic Correlates of Food Consumption

Cooperative research continued between HNIS and the University of California-Berkeley on the relationship between economic and sociodemographic factors and households' food consumption patterns. A major finding was that sociodemographic factors are explaining only a small proportion of the variation in food choices and dietary adequacy. Perhaps other types of data such as awareness of diet and health issues or the belief that one can control one's diet may better explain food choices.

- The Food Label as an Educational Tool

A research project investigating the characteristics of users of nutrition labeling and the effect of use of nutrition labeling on dietary status was initiated. Among major findings were: (1) Label use was positively associated with nutrition knowledge and with belief in the importance of following the principles of the Dietary Guidelines for Americans. Label users were more likely to believe that it was important to moderate cholesterol, fats, saturated fat, and sodium, and to increase complex carbohydrates, fiber, and variety; and (2) label use was positively associated with intake of vitamin C and negatively associated with intake of cholesterol. Results of this research were presented at the September 1992 meeting of the National Exchange for Food Labeling Education (NEFLE), an organization created jointly by FSIS and FDA to encourage and build partnerships to develop and evaluate educational materials and projects that reach all segments of the U.S. population. Results from these and other research projects are being incorporated into a reference guide on new nutrition labeling regulations. The publication is targeted for "information multipliers"--food editors, writers, extension staff, and other health professionals and educators--who will be explaining to their audiences how to use the new food labels to choose a healthful diet.

- Implications of Changes in the U.S. Food Supply for Nutrition Education

In relation to current dietary guidance, trends in the per capita food and nutrient supply were assessed by HNIS. A strategy to increase awareness, understanding, and use of food supply data with emphasis on interpretation and documentation for policy applications was developed and implemented. Three research articles were published in USDA's "Food Review." One focused on trends in nutrient levels between 1968 through 1988 in relation to changes in dietary recommendations during that 20-year period. Because much popular concern has focused on animal products as sources of fat, saturated fat, and cholesterol, a second article focused on trends in the use of animal products. In 1988, animal products contributed about half the total dietary fat in the food supply. Meat, poultry, fish, and eggs provided 34 percent of total fat, and 80 percent of the cholesterol. Milk and milk products provided 12 percent of the fat and 15 percent of the cholesterol. In the past 20 years, there has been a declining use of red meats and eggs, an increasing use of poultry, fish, and cheese, and a shift from whole milk to lowfat milk. The third article discussed trends in the use of fruits and vegetables because they are emphasized in the Dietary Guidelines for Americans, the Food Guide Pyramid, and the Year 2000 Health Objectives. Since the 1970's, the overall use of fruits and vegetables has increased. Use of fresh noncitrus fruit, such as bananas, grapes, apples, pineapples, and strawberries, and use of fresh vegetables, such as lettuce, onions, tomatoes, carrots, cauliflower, and broccoli, has increased.

Because diets high in omega-3 fatty acids have been reported to reduce the risk of cardiovascular disease, the levels and food sources of omega-3 fatty acids in the food supply were studied. This study, published in the Journal of the American College of Nutrition, identifies levels and sources of omega-3 fatty acids in the U.S. food supply from 1935 through 1985. Use of fish, the main source of omega-3 fatty acids, increased from 12 pounds per capita in 1935-39 to 19 pounds in 1985.

Increasing intake of calcium-rich foods is also a Year 2000 Health Objective and has been a focus of much of our educational materials. Therefore a short report was published on trends in calcium consumption in the food supply since 1909. This report highlights per capita consumption of calcium and dairy products, the major source of calcium from 1909 to 1988. In 1988 per capita consumption was 890 mg of calcium per day. This level is higher than at the beginning of the century (740 mg per day), but lower than the highest level of 1000 mg of calcium in 1945-49.

Because new and modified food products are being introduced into the U.S. food supply daily with uncertain potential effects on the American diet, a new research effort was started. As a first step, a literature search was completed on fat replacers, reduced-fat products, and sugar substitutes in the food supply. A reference file has been developed and includes information on fat-based, protein-based, and carbohydrate-based fat replacers; reduced-fat products specific to food supply commodities; fat-free foods; calorie alternatives; and sweeteners.

- Research To Develop and Maintain USDA Food Plans at Different Cost Levels

U.S. average food costs in food plans at four cost levels--thrifty, low-cost, moderate-cost, and liberal-cost--were estimated for the 48 conterminous States. These estimates were based on food price information from the Bureau of Labor Statistics (BLS) and they were released monthly by the USDA in press releases. Benefit levels for the Food Stamp Program (FSP) are established by the USDA using the food costs estimated for the Thrifty Food Plan (TFP). Food costs were also estimated for Alaska and Hawaii to establish separate benefit levels for FSP in those two States. Food Plan costs for the United States are published in "Statistical Abstract of the United States, 1992: The National Data Book," U.S. Department of Commerce, Bureau of the Census. The cost of food in the Thrifty Food Plan for the 4-person household, which is used by the Department in setting benefits for the Food Stamp Program, decreased 1.3 percent between June 1991 and June 1992.

- Research on Thrifty Food Plan Methodology

A partial revision of the TFP was completed. This revision focused on updated dietary guidance and new food composition data. It showed that, with very few exceptions, the Food Plans currently in use can be expected to meet current dietary recommendations. A report is being drafted which will provide an overview of the revision and details on food plan methodologies and recommendations for future TFP revisions. HNIS established a working group to discuss the next complete revision of the TFP. This group includes staff members from FNS, ERS, and ARS's Family Economics Research Group. This group has discussed the goals and objectives of the TFP and has begun reviewing the methodologies used in the development of the TFP. The working group provides the link among the agencies involved with food plan policy, survey data collection, and methodology development. A review and evaluation of recipes used to illustrate the TFP was also initiated.

- Interpretation of Measures of Food Expenditure

The potential consequences of using two different household food cost or expenditure measures on various policy issues, such as in an evaluation of the effectiveness of the Food Stamp Program, were studied. It was found that choice of food expenditure measure can have an impact on study outcomes. For example, if one wishes to study the impact of participation in the Food Stamp Program, actual household food expenditures should be used. If, on the other hand, one wishes to the study the impact of an additional person on household food expenditures, either the actual food expenditures measure, or a recall of "usual" food expenditures measure can be used.

- Assessment of Nutrition Education Needs of Pregnant Teenagers

A study with the University of Tennessee--Knoxville was initiated in 1991 to assess nutrition education needs of pregnant teenagers. A workshop with professionals who serve this clientele and focus groups with pregnant teens were held. Results indicated that teens preferred a video format for nutrition information and reacted positively to messages presented from the "baby's viewpoint" regarding healthy food choices during pregnancy. Professionals indicated that videos are desirable for use with teens, who have a wide range of literacy skills and attention spans. Based on needs assessment results, a prototype video tape dealing with healthful eating during the second trimester of pregnancy was developed. It will be tested with pregnant teens for appeal, comprehension, and usefulness of the information provided.

- Food Preparation Research

Ongoing research in HNIS's Food Research Laboratory provides information used in guidance materials that show consumers how to implement the Dietary Guidelines in food preparation. Moderation of fat, saturated fat, cholesterol, sugars, and sodium requires modification of amounts of ingredients and techniques for preparation of foods. For example, recent research focused on the minimum amounts of fat and sugars that can be used to make pastry, biscuits, muffins, cake, and cookies of acceptable eating quality. All recipes developed for publications or through research are evaluated by a trained taste panel for appearance, texture, flavor, and overall acceptability. Recipes also emphasize basic food safety rules and how to choose and prepare foods moderate in cost, with a minimum of effort, in keeping with today's life styles. Although consumers measure foods by volume (e.g., cups, tablespoons), foods measured by weight are required for food consumption monitoring, reports on the nutrient content of foods, and recipe development work. The Food Research Laboratory develops data to convert the volume measurements in recipes to weight measurements. A Home Economics Research Report on the methodology used by the laboratory staff for determination of weights for volume measures is being prepared.

- Evaluation of HNIS's Dietary Guidelines Teaching Kit for Home Economics Teachers

This study focused on the nutrition education needs of youth and children, including culturally diverse population segments. It is part of an ongoing effort to assess the unmet educational needs of special groups who are at nutritional risk. Brief interviews were conducted with junior and senior high school home economics teachers to determine information such as the course in which the kit was used, grade level and number of students reached, satisfaction with kit components, and suggestions for improving the kit.

Indepth interviews were conducted with teachers to focus on topics such as effectiveness of the kit in communicating with culturally diverse youth, how the kit could be adapted for use with younger children, and suggestions for communicating nutrition labeling and USDA food guide topics in future materials. Study results will be used to revise the teaching kit and to plan and develop classroom materials for the future.

2. Food and Nutrition Materials and Methods Research (HNIS)

- Research Base for the Food Guide Publication and Graphic

Several reports were released detailing the research conducted to develop and test a graphic presentation of the Food Guide developed by HNIS in the early 1980's. In early work done with the same target audience as for the Dietary Guidelines bulletin, it was found that the pyramid shape conveyed the concepts of variety, proportionality (choosing more of some foods than others), and moderation of food components linked to chronic diseases. Other graphics tested were unsuccessful; e.g., circle formats were considered "old," inverted pyramids were found distracting. Many other graphics were tested with high-risk groups such as children, low-income groups, and Hispanics in a large-scale evaluation project. Final testing was done on several variations of pyramid and bowl shapes and included more than 3,000 children and adults across the country. The pyramid and bowl were found to be about equal in conveying the concept of variety but the pyramid was more successful at conveying the concepts of proportionality and moderation. In addition, the pyramid conveyed less misinformation. The research reports also summarize the findings of the research conducted to develop the 32-page booklet which explains the Food Guide Pyramid. Formative evaluation was conducted with focus groups of adults with at least median income and high school education. Respondents found the information in the bulletin helpful in further explaining the concepts illustrated by the Food Guide graphic and the symbols in the graphic, representing fat and added sugars. Based on results of the focus groups, the prototype booklet was revised and prepared for publication. The publication was released in April 1992 and published as Home and Garden Bulletin 252 in August 1992. Single copies are available through the Consumer Information Center in Pueblo, CO, for $1.00 each. Bulk copies, in lots of 100, are available through the Government Printing Office, Washington, D.C.

- Nutrition Label Education for Consumers

Based on HNIS's research on the information needed to help consumers use the new food label to improve their diets, HNIS is preparing an eight-panel, reproducible leaflet which will identify label features that consumers can use to follow the Dietary Guidelines for Americans. This publication is part of the National Exchange for Food Labeling Education's educational outreach campaign, and is intended to be a companion to a leaflet developed by FDA providing basic information about the new food labels.

- Revision of Dietary Guidelines and Your Diet Publications

A project to revise a set of seven bulletins on using the Dietary Guidelines, HG 232 1-7, "Dietary Guidelines and Your Diet," and develop one new overview bulletin was completed in 1992. Design of the set was revised and formative evaluation of three prototypes was conducted with focus groups of adults with at least median income and high school education. Most focus group participants reacted very favorably to the content of the bulletins. They thought the bulletins were informative, useful, and convenient because, even if participants were already familiar with some of the information, the bulletins presented it in one place. Many felt that the way the bulletins "chunk" information into discrete sections allowed them to concentrate on manageable doses at one sitting. Humor and whimsy used in many of the illustrations lightened up and made enjoyable a topic that many participants generally find presented in a boring or pedantic fashion. Health and nutrition professionals responded to in-depth telephone interviews after previewing the three prototypes. Most felt that these booklets would be very interesting and appealing to their clients, who would find the information easy to follow and understand. However, participants felt that the special needs of lower income individuals should be further addressed, which could be done through a separate edition or a special supplement. Based on results of the focus groups and interviews, all eight bulletins have been prepared for printing and distribution as a set. In the past, these bulletins have been widely used by nutrition educators and incorporated into their programs in a number of ways. The bulletins are expected to be available through the Government Printing Office and the Consumer Information Center in Pueblo, CO.

- Dietary Guidelines Booklet for Adults With Low Literacy Skills

A project to develop and test a prototype booklet on using the Dietary Guidelines for adults with low literacy skills was completed. Under a cooperative agreement, the University of Nebraska adapted Dietary Guidelines information to a reading level for those who are functionally illiterate and formatted it into a booklet with simple line drawings. The booklet was tested using focus groups and individual in-depth interviews. The topic respondents chose most frequently as being most useful was weight control, followed closely by feeding young children. Participants had heard a great deal about current nutrition issues and knew about cholesterol, sodium, calories, and other topics.

However, they did not know about the food sources of these items or how to modify their diets and food preparation methods to follow the Dietary Guidelines. They were very interested in learning how to achieve a healthier diet. The following characteristics of the adapted publication on the Dietary Guidelines were well received by participants in this study: a single booklet format; a color photograph of food on the cover; layout with professional typesetting, highlighting, boxing key information, and clear illustrations; self-assessments; recipes with few ingredients, featuring easy desserts and main dishes; and specific information on calorie, fat, sodium, and sugar contents of foods, in tables, charts, illustrations, and on recipes. After testing, the prototype booklet was revised and prepared for USDA publication. "Making Healthy Food Choices" (Home and Garden Bulletin Number 250) is available through the Government Printing Office, Washington, D.C.

• Dietary Guidelines Publication for Healthy Older Adults

The Human Nutrition Information Service (HNIS) and the National Institute on Aging (NIA), DHHS, have worked together to develop a publication entitled "FOOD FACTS FOR OLDER ADULTS: Information on How To Use the Dietary Guidelines." The information is directed to older adults about ages 60 to 75, who are generally in good health (not on physician prescribed diets), live independently (not in institutions), and have at least a high school education. Information was based on that provided in HNIS's "Dietary Guidelines and Your Diet" series (HG 232 1-11), and supplementary information was developed as needed to address specific topics of importance for this audience. A panel of professionals involved directly with the target audience of older adults suggested content topics, approaches for sequencing the information, specific content features, and formatting options. A rough prototype publication was prepared and reviewed by four focus groups of older adults. Reactions to the content of the proposed materials were generally favorable. Content features that were particularly well liked by participants included "Did You Know" sections, tips, food composition comparisons, self-assessment quizzes, question and answer features, annotated menus, and recipes. The larger typeface in the prototype publication was also well received. The publication includes an introduction describing the Dietary Guidelines; information about fat, cholesterol, and sodium; special advice for older adults on fiber, calcium, and using the Food Guide Pyramid; tips on making healthy food choices when shopping and cooking; maintaining a healthy weight; answers to common questions older people ask; tips and recipes for each food group; and a resource list to obtain more information.

• Dietary Guidelines Teachers' Guide for Health Educators

"Dietary Guidelines and Your Health--Health Educator's Teaching Kit" was developed in cooperation with the Association for the Advancement of Health Education (AAHE) to help teach Dietary Guidelines concepts to junior and senior high school students. The primary component of the Kit is a teacher's guide that includes objectives, key concepts, lesson plans, and learning activities that introduce the Dietary Guidelines. A panel of health educators who work with junior and senior high school students assisted in a needs assessment for teaching materials for this audience. The panel helped develop ideas for both the format and content of the Guide. For example, the panel's interest in fitness as it relates to diet and health led to the development of a "Fitness On the Move" component for each lesson plan. Similarly, since fast foods are very popular with teens, a learning activity demonstrating the number of teaspoons of fat in a typical fast food meal was included in the lesson plan on how to choose a diet low in fat. Single copies of the Teaching Kit will be distributed to teachers upon request, and to other health professionals attending annual meetings. Bulk copies will be provided by HNIS to training leaders planning to conduct teacher in services in health education. HNIS staff will participate in some of these training sessions.

• Revision of Calories and Weight Publication

Overweight is a problem for about one-quarter of American adults and this problem is associated with a number of chronic diseases. To reduce the risk of being overweight, both exercise and diet are important. The Dietary Guidelines for Americans include the guideline "Maintain Healthy Weight." To help consumers follow this guideline, HNIS developed a pocket calorie guide. This publication includes information on the number of calories in about 450 foods as well as general weight control guidance. The calorie values for foods were calculated using current nutrient composition data for foods as eaten and revised weight-for-volume measures determined by HNIS's Foods Laboratory staff. The publication is expected to be available through the Government Printing Office and the Consumer Information Center in Pueblo, CO.

• USDA's Dietary Analysis Program

Distribution of USDA's Dietary Analysis Program continued through the HNIS Nutrient Databank Bulletin Board and the National Technical Information Service (NTIS). The program was developed by HNIS in cooperation with the Extension Service for use in consumer nutrition education programs at work sites, community health sites, schools, etc. The program is interactive and user friendly; consumers use a series of menus to select foods and estimate amounts eaten. The program helps consumers to identify major food sources of nutrients in their diets, and to explore how they can change food selections to bring about positive nutritional outcomes (such as fewer calories or less fat). In 1992, work was initiated to update the nutrient data base to that used in the 1990 Continuing Survey of Food Intakes by Individuals. The interpretive materials that accompany the software are also being revised to reflect the 1990 Dietary Guidelines and the Food Guide Pyramid recommendations.

H. Food Marketing and Demand

1. Studies on Food Supplies, Prices, Expenditures, Marketing Costs, Safety, Technology, and Consumer Demand

• Commodity Supply and Utilization

ERS annually calculates the amount of food available for human consumption in the United States, and publishes the information in Food Consumption, Prices, and Expenditures. The 1992 bulletin covered the period 1970 through 1990 (ERS, SB-840, August 1992, 148 pages). It presented historical data on per capita consumption of major food commodities in the United States, including the basic data on supplies and disposition from which the consumption estimates are derived. In addition, information concerning population, income, prices, and expenditures related to food consumption through the period covered by the quantity data was assembled to meet the need for a comprehensive and convenient source of data for people doing statistical and economic analysis of food consumption. An electronic data base containing the data in this report is available. This data base is in the form of Lotus 1-2-3 spreadsheet (.WK1) files on DOS-compatible diskettes. In addition to the historical series, ERS also analyzes the current situation and forecasts the short-term outlook for major agricultural commodities, agricultural trade, agricultural finance, agricultural resources, and world agriculture in a host of periodic outlook reports and in Agricultural Outlook and Food Review. For information, call Judy Putnam (202) 219-0862.

• A New Broiler Consumption Series

Carcass and retail weight consumption series for red meats and ready-to-cook (RTC) weight consumption series for poultry have been published in ERS' Livestock and Poultry Situation and Outlook Report (LPS) for many years. The RTC series reflects dressed poultry production and is similar to the carcass weight series for red meat. A retail weight consumption series for broilers, which facilitates economic comparisons with red meat retail series, was introduced in 1992. Conversion factors are used to adjust RTC consumption to a retail weight equivalent. The conversion factors reflect the increased share of total processor product diverted from the human food chain and into rendering and pet food use as more products are sold cut-up or boneless. Beginning in the 1980's, processing and marketing developments in the broiler industry caused RTC weight and actual retail weight to diverge significantly. Some broiler parts were available in retail tray packs during the 1970's, but in the 1980's broiler processors' marketing strategies shifted dramatically, making more cut-up, further processed, and boneless broiler products available. Because of this changing product mix, more bones and some broiler meat now go to rendering and pet food manufacturing. In 1981, the volume of broiler products going to other than human consumption was estimated at nearly 2 percent of broiler weight processed, but by 1989 it was over 11 percent. The new retail weight series more accurately reflects the pounds of poultry meat flowing into the domestic market for human consumption. Each year conversion factors are calculated to estimate the proportion of RTC product entering the human food chain. "Introducing a Broiler Retail Weight Consumption Series" (by Agnes Perez, Lawrence Duewer, and Mark Weimar) in LPS-53 (ERS, May 1992) presents conversion factors and the new retail weight estimates for 1979 through 1991.

• Imports Account for Significant Portion of U.S. Produce Consumption

Markets for fresh fruit and vegetables are increasingly global as improved refrigeration and transportation have made it possible to expand supply sources. This increase in trade has expanded the variety and seasonal availability of fresh fruit and vegetables to U.S. consumers. In 1990, U.S. imports from all sources accounted for 12.3 percent of total fresh fruit consumption, excluding bananas (35.3 percent if bananas are included), and 8.4 percent of total fresh vegetable consumption. As trade barriers are reduced, trade in fresh fruit and vegetables likely will continue to rise. The potential of Mexico as a supplier under a North American Free Trade Agreement would also be a factor in the continuing globalization of fresh fruit and vegetable markets. In 1990, Mexico supplied about 2.5 percent of U.S. fresh fruit consumption, excluding bananas (3.3 percent including bananas), and 5.4 percent of fresh vegetables consumed in the United States "Fresh Produce: The Global Factor" (by Boyd M. Buxton and Dennis A. Shields) in Agricultural Outlook (ERS, December 1992) presents U.S. consumption, imports as a share of consumption, and imports from Mexico as a share of consumption for selected produce items.

• Imports Increase Consumption of Fresh Grapes

When Chile began exporting fresh-market grapes to the United States in the 1970's, some U.S. growers feared imports would reduce consumers' interest in grapes during California's peak shipping season from May through September. However, larger imports from December to May actually coincided with a substantial rise in total fresh grape consumption--both imported and U.S.-grown. Increased domestic production of seedless grapes, higher quality, lower relative prices, extended seasonal availability, and consumer concerns about nutrition and health have led to strong and steady growth in consumption of fresh grapes. Per capita consumption, which tripled from 1970 to 1991, grew faster than other traditional fresh fruits. Better postharvest handling has improved the quality of grapes reaching consumers. For example, growers have recognized the importance of removing field heat immediately after picking, thus preserving quality and extending shelf life. Growers now pick grapes at the optimal time for peak ripeness and pay more attention to trimming the fruit bunches to enhance quality. Lower prices of fresh grapes relative to other fruit made grapes a more attractive purchase for the consumer. Although the U.S. average retail price for fresh grapes rose from $1.06 per pound in 1980 to $1.40 in 1991, prices adjusted for inflation declined about 20 percent. Inflation-adjusted prices for citrus, on the other hand, rose about 10 percent over the same period. "Winter Availability Boosts U.S. Grape Consumption" (by Dennis Shields) in Agricultural Outlook (ERS, December 1992) presents annual U.S. utilized production, imports, exports, domestic utilization, and per capita availability for marketing years 1980/81 through 1991/92.

• Revised Exports Lower U.S. Per Capita Supply Series for Fresh Vegetables

Data for U.S. exports of vegetables to Canada were underreported for many years. This was especially troublesome for fresh vegetables since Canada is the destination for over 90 percent of U.S. foreign sales. The problem became acute in the early 1980's with U.S. exports of many items totaling less than half the levels reported in Canadian trade statistics. Despite the switch to the harmonized trade system in 1989, U.S. export reporting did not improve. In 1990, the Bureau of the Census began substituting Canadian data on imports from the United States in place of U.S. customs data. The improved reporting resulted in a huge jump in the data series from 1989 to 1990, prompting some to erroneously credit the rise solely to the U.S.-Canada Free Trade Agreement.

The solution to this inconsistent data series was to replace the underreported U.S. exports to Canada with Canadian imports from the United States prior to 1990. ERS updated the major fresh vegetable export series from 1978 to 1989. This yielded a smoother series, which is much more representative of actual U.S. fresh vegetable trade. Since exports are a component of supply and use tables, the immediate result of this change was to reduce U.S. per capita use estimates for most fresh vegetables. For example, 1987 iceberg lettuce consumption was revised from 25.0 to 23.9 pounds per capita, tomato consumption was revised from 14.6 to 13.5 pounds per capita, and broccoli consumption was reduced from 3.3 to 2.8 pounds per capita. The 1987 total per capita fresh vegetable consumption estimate (excluding potatoes) came down 5.9 pounds (about 6 percent) to 97.2 pounds. ERS has incorporated these new export estimates into the U.S. food supply electronic data base.

• Revised Exports Lower U.S. Per Capita Supply Series for Most Fresh Fruit

Canadian import data for 1978 through 1989 indicate that more fruit was exported from the United States to Canada than had been reported by the U.S. Commerce Department. For most fruits, the underreporting was more marked in 1983-87, but the differences varied among commodities and from year to year. In 1984 and 1985, Canadian imports of fresh peaches and nectarines were more than double those reported; U.S. exports of fresh strawberries to Canada were 100-150 percent underreported from 1985 through 1989; and, from 1981 through 1989, avocado imports were from two to eight times higher than reported by Commerce. Canada received a large share of all U.S. fresh fruit exports in 1978-89, so substituting Canadian import data for U.S. export data increased total U.S. exports for almost all types of fresh fruit. Total peach and nectarine exports increased over 100 percent in both 1984 and 1985, because most U.S. exports were to Canada. A smaller share of U.S. avocados went to Canada, so the change in total avocado exports was less than 50 percent in most years. For many of the fresh-market fruits, exports were small compared to total supply, so even large revisions in export figures had little impact on domestic use. Revisions for 1978-89 export data lowered per capita use estimates slightly. For example, 1985 citrus fruit consumption was revised from 22.64 to 21.55 pounds per capita and noncitrus consumption from 66.70 to 65.26 pounds per capita, so the 1985 total fruit consumption estimate came down 2.53 pounds (about 3 percent) to 86.81 pounds.

• Per Capita Dry Edible Bean Consumption Increasing

At a time when health concerns, convenience, and environmental issues are exerting a greater influence on consumers' food choices, dry edible beans are getting a second look--from both consumers and producers. The legumes are useful in sustainable production practices--making them attractive to farmers considering crop rotations. For consumers, dry beans offer low cost, nutritional content, versatility, and convenience. The United States produces over a dozen varieties of dry edible beans, but a few favorites account for most of the U.S. dry bean output--pinto (41 percent of 1989-91 output), navy beans (21 percent), Great Northern (8 percent), and red kidney (7 percent). Other varieties include large lima, baby lima, small white, pink, small red, cranberry, black, blackeye (also called cowpeas), and garbanzo (also called chickpeas). These are the varieties for which USDA carries production statistics, but many other specialized varieties are produced in smaller quantities and included as miscellaneous output in USDA statistics. Among these are fava beans (sometimes called horse or broad beans), mung beans, adzuki beans (popular in Japan), marrow beans, appaloosa beans, Christmas limas, and anasazi (a native bean similar to pintos). Relatively inexpensive, dry beans are an excellent source of vitamins, minerals, soluble dietary fiber, and protein. The leading source of vegetable protein, dry edible beans are among the best food buys in terms of cost per gram of protein. They contain no cholesterol, and research suggests that regular consumption of beans may help lower blood cholesterol levels. Dry beans are also rich in B-vitamins, iron, calcium, potassium, and phosphorus, and very low in sodium and calories. Concern for nutrition is just one factor boosting dry bean consumption. Along with the rising popularity of restaurant chains specializing in Mexican and East Indian cuisine, interest over the past decade in ethnic foods featuring dry edible beans is also bringing beans back into the American culinary mainstream. Dry edible bean use peaked during World War II at 11 pounds per person, then began a steady decline. Since bottoming out in the early 1980's, per capita consumption has increased 15 percent. From 1980 to 1984, dry bean use averaged 5.9 pounds per person. Over the next 5 years (1985-89), average use increased 7 percent to 6.3 pounds. The years 1990-92 saw an 8-percent gain over the 1985-89 period, to 6.8 pounds. For further information, see "Dry Edible Beans Get a Second Glance" (by Gary Lucier) in Agricultural Outlook (ERS, December 1992).

• Frozen Potatoes Edge Out Fresh in Per Capita Use

The most significant changes in potato consumption over the past 30 years have been the rise of frozen potato use and the decline of fresh use. In 1959/60, only 4 percent of the crop was processed into frozen potato products. By 1990/91, one-third of all potatoes grown in the United States was processed into frozen products, mainly french fries. The popularity of fast-food restaurants is behind much of the growth in frozen potato use. In 1991, about 87 percent--4.8 billion pounds--of frozen french fries was sold by foodservice outlets. With the success of frozen potato products and increased demand for potato chips and other products made from dehydrated potatoes, U.S. per capita consumption rose from 106 pounds in 1959 (farm-weight equivalent) to over 130 pounds in 1991. The gains in per capita consumption, however, mask the large decline in fresh table use. In 1960, fresh use totaled 81 pounds per person, but by 1989, fresh consumption tallied just under 50 pounds. The drop of more than 30 pounds per person in fresh potato use contrasts with the 59-pound gain in consumption of processed potato products over this period. Evidence suggests that fresh use has now leveled off and may be on the rise. The increased popularity of fresh produce in general and the convenience of microwave ovens are likely among the factors. For further analysis, see "Potatoes--An American Classic" (by Gary Lucier) in Agricultural Outlook (ERS, October 1992).

• An Apple A Day--Or Two

U.S. per capita consumption (disappearance) of apples and apple products has grown almost 2 percent per year since 1970, partly because apple juice consumption tripled over this period. On the other hand, per capita canned apple consumption showed no growth, while fresh apple consumption grew almost 1 percent annually since 1970--the same increase all fresh fruits enjoyed. Apples have held on to their share of fresh fruit consumption, while banana, strawberry, and grape consumption increases have more than offset declines in fresh citrus. The growing availability and popularity of nontraditional fruits like mangoes and other tropicals represent additional competition for fresh apples. Relative prices for these nontraditional fruits have declined, making them more price competitive with traditional fruits like apples.

Consumers weigh quality as well as price when shopping for fruit, and all fruits, including apples, compete for a piece of the growing fresh fruit consumption pie. Consumers may be willing to pay more for apples, and for fruit in general, if their knowledge of the nutritional health benefits of the products increases. A recent consumer survey found that price is not always the highest priority for apple consumers. High fiber and vitamin/mineral content and low calories are also important factors in consumers' purchase decisions. Emphasizing quality over price as a way to boost sales seems to be an appropriate marketing strategy for the industry, especially since fresh apple prices have risen sharply (in real terms) in the last few years. This was an approach taken by the Washington industry a few years ago when it identified the importance of firmness standards that lead to crisper fresh apples. After the State took steps to increase those standards, initial grumbling by growers turned to praise. Many growers now feel the change helped increase demand for fresh apples. Apple promotion is getting an extra push from the 5 a Day for Better Health campaign to double U.S. per capita consumption of fruits and vegetables by the year 2000. Campaign sponsors are the National Cancer Institute and the produce industry's Produce for Better Health Foundation. Associated advertisements and improved nutrition information and dissemination should have a positive effect on demand for fruit, including apples. USDA supports the 5 a Day campaign. Many of the 5 a Day advertisements include USDA's Food Guide Pyramid, which recommends that people eat 2 to 4 servings of fruits a day. Technological and managerial changes, including the conversion to high-density apple orchards, have increased yields almost one-third from 1970 to 1990. Future production gains are likely, as more and more old blocks of trees are replaced with higher density plantings. For further information about apple production and marketing, see "A Sweet Year for U.S. Apple Growers" (by Dennis Shields) in Agricultural Outlook (ERS, July 1992).

• New Per Capita Supply Estimates for Canned Fruits

Beginning in 1990, pack and stock data for a variety of canned fruits were no longer available from several key industry participants and, therefore, the per capita use figures for canned fruits were not updated for 1989 or 1990. In 1992, ERS developed an alternative procedure for estimating canned fruit consumption using data on utilization for canning as reported by NASS. Domestic consumption of a commodity, for the designated time period (calendar or crop year), is typically estimated by taking domestic production, adding beginning stocks and imports, and then subtracting ending stocks and exports. Until discontinued in 1990, industry pack and stock data for canned fruit (apples, apricots, sweet and tart cherries, fruit cocktail, peaches, pears, plums and prunes, and olives) were used as the measures of domestic canned production and stocks. With the new procedure, the NASS estimate of the amount of selected fruits used for canning is used as the measure of canned fruit production or pack. The fresh weight of fruits used for canning is converted into its product-weight equivalent using standard conversions. There still are no measures of canned fruit stocks. Therefore, stock adjustments are excluded from the per capita calculations. Imports and exports, as in the past, are obtained directly from the U.S. Department of Commerce trade data. Because the new procedure does not reflect beginning or ending stocks, the supply estimates can be biased for any given year, but not necessarily biased for the general trend of consumption. For example, when stocks increase from the beginning to the end of the period, consumption estimates would be overStated, as the stock buildup would be erroneously included in the consumption estimate. Likewise, when stocks decrease, consumption would be underStated, as the drawdown on stocks would be erroneously excluded from the consumption estimates. However, over time, stocks tend to fluctuate around a relatively constant desired level. The transfer from industry to NASS utilization data changed somewhat the mix of canned fruit products for which per capita supply numbers are calculated, reflecting the availability of data. Canned utilization data are estimated by NASS for apples, apricots, cherries, peaches, pears, plums and prunes, and olives. Fruit cocktail had previously been estimated as a separate canned fruit item. However, under the new procedure, all fruits used in canned fruit cocktail will be included with the processed utilization for each canned fruit. Results indicate that the old and new procedures provide similar estimates of per capita supplies for apricots, peaches, and prunes and plums. For cherries and pears, the new estimates are more than double the old estimates. The discrepancies could be due to a number of factors, including previous underreporting of the pack by the industry. Also, in the case of pears, the NASS processed-pear utilization data include pears canned in fruit cocktail, but these were not included with industry pack used in the previous procedure. For canned apples and olives, the new estimates are identical to the old as NASS utilization estimates were used under both the old and new procedures.

• New Procedure for Calculating Per Capita Fruit Juice Supply

A new procedure for calculating per capita fruit juice use was instituted in 1992. Previously, separate use figures were calculated for concentrate, canned, and chilled citrus juice using industry pack statistics, USDA cold storage reports, and Commerce Department trade data. The new procedure varies from the old in its measurement of U.S. juice production. USDA data on crop utilization for juice has replaced industry pack statistics. Changes in stocks for Florida orange juice and grapefruit juice are reflected in the calculations. The consumption is reported as gallons of single-strength equivalent, whether consumed as concentrate, canned, or chilled products. This procedure allows estimates of lemon, lime, apple, and grape juice that were not previously estimated. The consumption estimate also reflects the consumption of juice in blended mixes as well as straight juice. Total per capita citrus juice use has been quite flat at 5-6 gallons in the last two decades. Most is orange juice, with usage at less than one-half gallon for grapefruit and about one-tenth of a gallon for both lemon and lime juice. Per capita orange juice use dropped from 5.0 gallons in 1989 to about 4.3 gallons in 1990, reflecting high prices after the severe Florida freeze in December 1989. Orange juice supplies recovered some in 1991 but still did not reach the prefreeze level of over 4.7 gallons. Per capita apple juice use continued to show a strong upward trend, reaching 1.75 gallons in 1991. This is more than three times the usage rate of the early 1970's. More than half of total consumption has been supplied by imports in recent years. Per capita use of grape juice has been almost constant at 0.2-0.3 gallons. Total per capita use of selected citrus and noncitrus juices has been near 7.5 gallons annually since 1985, except for 1990 when it dropped due to high prices following freeze damage to the Florida orange crop. Insufficient information is available to calculate per capita use of pineapple and cranberry juice, which are likely significant quantities. Insufficient data also preclude the calculation of other minor use juices such as raspberry and guava. For annual per capita use estimates for 1971-91, see Fruit and Tree Nuts Situation and Outlook Yearbook (ERS, TFS-263, September 1992).

• Citrus Crops Showing Signs of Recovery After Severe Freezes in 1989 and 1990

Severe freezes in Florida and Texas in December 1989 and in California in December 1990 caused some severe citrus tree damage and significantly lowered per capita availability of fresh citrus fruits and citrus juices in 1990 and 1991. For example, domestic orange juice production dropped from 973 million gallons (single-strength equivalent) in the 1988/89 season to

652 million gallons in 1989/90, and per capita supplies fell from 5.0 gallons in 1989 to 4.3 gallons in 1990. Florida orange production in 1990/91 rebounded from the Decem-

ber 1989 freeze but, at 888 million gallons, was still below the prefreeze level. However, the increasing number of bearing acres will likely produce larger crops in the next few years. Every 2 years an inventory of citrus trees and planted citrus acreage in Florida is conducted by USDA and Florida Agricultural Statistics Service. A preliminary report based on the 1992 inventory shows that Florida has the most acreage since 1982--791,290 acres of citrus groves--and points to larger orange, grapefruit (especially red and pink varieties), tangerine, and lemon crops in the future, barring devastating freeze or disease losses. The Florida citrus industry continues to move further south, reducing chances for damage from cold temperatures. For further information about the inventory, see "Florida Citrus: More Trees, Wider Area" (by Diane Bertelsen) in Agricultural Outlook (ERS, November 1992).

• Mushroom Crop Sprouts With Consumer Demand

While mushroom production has grown steadily during the past decade, a major shift has occurred between the shares destined for fresh and for processed consumption. Fresh mushroom use was traditionally small, because of perishability. Until the early 1980's, most of the mushrooms consumed by Americans were canned. Annual canned consumption was 1.8 pounds per capita in 1980, compared with only 1.2 pounds of fresh mushrooms. The turnaround came in the 1980's, when the use of processing mushrooms rose only 2 percent annually, while growth in fresh mushroom consumption, aided by one-touch packaging which improved fresh mushroom life, increased at an average annual rate of 5 percent. In 1992, the fresh market accounted for about 70 percent of the mushrooms produced. Mushrooms are a multimillion-dollar U.S. business, but growers face a number of challenges arising from increasing environmental sensitivity. For an in-depth analysis of the mushroom industry, see "Mushrooms Cap a Decade of Growth" (by Shannon Reid Hamm) in Agricultural Outlook (ERS, June 1992).

• Canola Is Making Inroads

Since canola obtained GRAS (Generally Recognized As Safe) status in 1985, interest in the oil has grown in the United States. Interest has been piqued more recently by perceived health benefits of canola, with the lowest saturated-fat content--6 percent--of the major vegetable oils on the market. With oil consumption and imports increasing, and in light of new farm program flexibility that increases the attractiveness of domestic canola production, attention has shifted to the potential opportunities for U.S. farmers and processors. Canola is the popular name of rapeseed varieties that are low in erucic acid and glucosinolates, and therefore suitable for human consumption. Like soybeans, canola yields both oil and meal. Canola is a relatively "soft" oilseed, containing 40 percent oil that accounts for 60-70 percent of the overall seed value. The oil is suitable for use in salad and cooking oils and in baking and frying fats. Further along the marketing channel, canola reaches consumers in processed foods such as potato and corn chips, mayonnaise, and baked products. In these markets, canola competes with other vegetable oils, including soybean, cottonseed, corn, and sunflowerseed oils.

Domestic use of canola in the United States is growing and is projected to have reached 695 million pounds in the 1991/92 marketing year, up 185 percent from 1987/88. Canola's rapid rise in popularity is attributable to a number of factors relating both to the technical characteristics of the oil and market economics. For further analysis of market trends, see "What's in the Future for Canola?" (by Ian McCormick and Bengt Hyberg) in Agricultural Outlook (ERS, August 1992).

• The Market for New Fat Substitutes

With food labels carrying greater and more useful nutrition information, competitive pressures to offer truly lower fat products have many manufacturers scrambling to reduce the fat in their products through reformulations or the use of fat substitutes. ERS expanded an earlier analysis of the potential market for fat substitutes to include ground beef and selected processed beef and pork products. ERS found these meat products offer a potential 3.2-billion-pound annual market for fat substitutes. The fats and oils and dairy products markets offer a potential 17.7-billion- pound market for fat substitutes. How much of a market fat substitutes will claim depends on FDA approval, the substitutes' quality and versatility, strength of consumer demand and willingness to pay for reduced-fat products, and marketing strategies. This analysis is discussed in "Fat Substitutes in Foods: Growing Demand and Potential Markets," an invited paper authored by Rozanna M. Morrison and presented at the 20th International Society for Fat Research World Congress/83rd American Oil Chemists' Society Annual Meeting, Toronto, Canada, May 10-14, 1992.

• Organic Produce

The organic produce industry has been quietly gaining ground for several years, despite lagging supermarket sales and the tentative response of big food processors. Sales through other outlets are on the rise, as are the number of growers. The amount of acreage devoted to organic orchards, vineyards, and vegetable farms has also been expanding. A survey by the *Christian Science Monitor* in early 1991 estimated that the number of certified organic farmers nationwide more than tripled between 1988 and 1990, to 3,447 certified growers. A University of California survey reported a total of 5,328 organic growers in 1990, including both certified and noncertified growers. Congress passed the Organic Foods Production Act as part of the 1990 farm legislation. The objectives are to define national standards for organic food, assure consumers that food marketed as organic meets these standards, and facilitate interState trade in organic foods. The Secretary of Agriculture is required under the law to establish a certification program that will set national standards for the production, handling, and marketing of organically produced foods. For further analysis, see "Success Steady in Organic Produce" (by Cathy Greene) in Agricultural Outlook (ERS, May 1992).

- Sustainable Agriculture

Agricultural productivity in the United States and other areas of the world has been unprecedented in the last four decades. Over a 20-year period from the mid-1960's to 1985, for example, global cereal production jumped 81 percent, while population grew by 45 percent. However, many observers assert that the improved productivity has not been without costs, precipitating soil erosion and compaction, water quality problems, and controversies about the relation of food safety to heavy pesticide use. The very success of the "Green Revolution" has set the stage for a more "sustainable" agriculture that minimizes the impact of agriculture on the environment. At the root of the sustainability movement is a concern about the ability to manage the natural resource base so that food and fiber needs of future generations can be met at an acceptable environmental cost. But no general agreement exists on how to successfully incorporate the protection of natural resources into the productivity equation. Together with the research community and government, farmers are applying new practices and approaches--in crop rotation, alternative tillage, pest control, and soil maintenance--to lessen the impact of agriculture on the environment, while maintaining growers' incomes. For further analysis, see "Sustainable Agriculture: What's It all About?" by G. Gajewski and others (Agricultural Outlook, ERS, May 1992) and "Sustainable Agriculture: Putting It into Practice" (by G. Gajewski and others) in Agricultural Outlook (ERS, July 1992).

- Rice Consumption Is Heaviest on East and West Coasts

Although rice remains a relatively small part of the average American diet, total and per capita rice consumption (disappearance) in the United States have risen substantially since the late 1970's. Among the reasons are a rapidly growing Asian- and Hispanic-American population, consumer health consciousness, more convenient rice products, a larger variety of rice dishes and flavored mixes, and new uses for rice such as pet food. Per capita use of rice varies greatly among regions and States. The Middle Atlantic region had the highest per capita use in 1989, almost 17 pounds. The Pacific region was a close second at 16.7 pounds, followed by the South Atlantic region at 11 pounds. For further information about rice consumption patterns, see "Rice Industry Looking Homeward for Growth" (by Nathan Childs) in Agricultural Outlook (ERS, March 1992).

- Trends in World Meat Trade

Over the past 10 years, worldwide meat consumption patterns have changed considerably. Government regulations, changing lifestyles and incomes, and attitudes about the relationship of meat consumption to health, as well as technological change, are among the factors reshaping world demand. Although meat production has grown steadily over the past decade and trade is brisk in some markets, trade is actually a small share of total output, while consumption and production remain concentrated among a few countries and regions. For further analysis, see "Global Meat Consumption & Trade" (by Shayle Shagam and Linda Bailey) in Agricultural Outlook (ERS, April 1992).

- World Food Consumption

Global per capita food consumption continued rising in the late 1980's, but at a slower pace than in the 1960's and 1970's. Diets in most regions have improved, too. But not all: Africa has become the poorest fed geographic region--with the diet virtually unchanged in the last 27 years. For more details, see "Growth in World Food Consumption Slowed in the Late 1980's" (by C.E. Overton) in Food Review (ERS, Volume 15, Issue 1, January-June 1992).

- The Food Marketing Revolution

The ERS report Rearranging the Economic Landscape: The Food Marketing Revolution, 1950-91 (by Alden C. Manchester, ERS, AER-660, September 1992, 165 pages) focuses on the pervasive changes in food marketing since World War II. Changes in the makeup of the population, lifestyles, incomes, and attitudes on food safety, health, and convenience have drastically altered the conditions facing farmers and marketers of food products. Manufacturers and distributors have made vigorous efforts to meet changing consumer wants and needs. Household and family size have declined due to later marriages, more divorces, smaller families, and less doubling-up (two families in one household). The proportion of families with more than one earner began to increase sharply after World War II: from 39 percent in 1950 to 58 percent in 1990. As incomes and the number of multiple-earner families rose, Americans ate out more often. The share of food expenditures away from home rose from 25 percent in 1954 to 46 percent in 1990. More money and less time for food shopping, preparation, and eating in many households have made convenience the key. In families where all the adult members work outside the home, time for meal preparation has shrunk from 30 minutes a few years ago to 20 minutes today. Interest in convenience and health has altered what Americans eat at home. Between the early 1970's and the mid-1980's, consumers began eating more poultry, cheese, fresh fruits and vegetables, processed fruit and juices, cereal products, and other prepared foods and less beef and pork, processed vegetables, bakery products, sugar and sweets, and coffee and tea. Responding to consumers' desires for convenience and healthfulness, food manufacturers have reshaped the composition of the food basket. Technological developments have created whole new industries and transformed all the old ones. These changes mean that manufacturers now look for altered or new products from farmers and that farmers must adjust to the changing demands. Farmers are paid increasingly on the basis of their ability to provide commodities that meet buyers' specifications. The supermarket boom was the dominant development in food retailing from the end of World War II to the mid-1960's. Since then, retailers have used increasingly diverse strategies to attract consumers. The dominance of chains, owned or franchised, in fast-food and, to a lesser extent, in full-service restaurants means that menus do not change from day to day. So, demand for specific foods is not very responsive to price. Fixed-menu eating places now do much more business than restaurants with more flexible menus that can adapt to rising prices by choosing less costly items. The economic landscape in food manufacturing has been drastically rearranged. Large companies are manufacturing a greater share of food and are more diversified in a variety of food products and nonfood products, although there has been some withdrawal from nonfoods in recent years. Large food companies are also moving toward specialization in a single segment of the market: products for the grocery store trade, products for food service, or ingredients for other manufacturers. Many of these changes have taken place through mergers, acquisitions, leveraged buyouts, and divestitures.

• Food Marketing Review

Food Marketing Review, 1991 (ERS, AER-657, March 1992, 140 pages) provides an in-depth view of the U.S. food marketing system. It examines developments in all firms servicing the U.S. food supply--manufacturing, wholesaling, and retailing. This ERS report focuses on what's happening in the U.S. food marketing system as fewer but larger firms compete for limited retail shelf space and a share of the consumer's food dollar. Here's a sampling of the topics covered in detail by this fact-filled report from ERS.

- A smaller portion of the Nation's resources are being used each year to feed a larger population. But to compete in a slow-growth market, food manufacturers are issuing record numbers of new products and competing for shelf space in a system increasingly dominated by fewer but larger firms.

- Retail sales of the food marketing system failed to keep up with inflation in both 1990 and 1991, but reached about $750 billion in 1991. Wage and price stability helped keep processor and retailer operations profitable in both 1990 and 1991, despite poor sales growth.

- *In both 1990 and 1991, the food system continued its* restructuring, global thrust, automation, and competition for the consumer dollar.

• The Farm-to-Retail Price Spread

Consumers, farmers, and legislators want to know what causes food prices to change. These concerned parties are also interested in the difference between what farmers get for the food they sell and how much consumers pay for that food, commonly referred to as the farm-to-retail price spread. To answer these concerns, Congress has directed the USDA to measure price spreads for food originating on U.S. farms. An ERS report presents USDA's findings for 1991, including answers to the following questions: How much did food prices rise in 1991? Why? How much of the retail food price does the farm value represent? How did farm-to-retail price spreads change in 1991, both for a market basket of food and for such food groups as meat and dairy products? How have recent developments affected food industry costs, profit margins, and productivity? Finally, how much did Americans spend for farm-produced food, and how were these dollars divided among costs of producing and marketing food? For further analysis, see Food Cost Review, 1991 (by Dennis Dunham, ERS, AER-662, August 1992, 50 pages).

• Food Prices

ERS forecasts the Consumer Price Index for all food, food away from home, and food at home, including 16 subaggregates of food at home. An annual forecast is released in late November or early December each year at the National Agricultural Outlook Conference. Updates appear in Agricultural Outlook (ERS, USDA, monthly) and are available from ERS economist Ralph Parlett (202-219-0870).

• Total Food Expenditures

Americans spent $583 billion for food in 1991 and another $86 billion for alcoholic beverages. Away-from-home meals and snacks captured 45 percent of the U.S. food dollar in 1991, up from 34 percent in 1970 and 24 percent in 1950. ERS prepares annual statistics of total dollar expenditures for food at home and away from home. These figures include all food, regardless of who pays for it. Total food expenditures are further broken down into the share paid for by families and individuals and those paid for by governments and businesses. Annual statistics are published in Food Consumption, Prices, and Expenditures and monthly figures in Agricultural Outlook, both published by ERS.

- Annual Household Food Expenditures Rose to $1,652 Per Person in 1992

From 1986 to 1990, after-tax household income rose 25 percent. Food spending kept pace, also rising 25 percent. Consequently, the 15-percent share of after-tax household income allocated to food did not change. However, spending for some food categories rose faster than for others. For more detailed information, see "Per Capita Food Spending Up 25 Percent in 4 Years" (by James R. Blaylock and David M. Smallwood) in Food Review (ERS, 15:2, July-September 1992).

- Food Spending by Female-Headed Households

An ERS study suggests that, on a per person basis, female-headed households with children spend less for food than do two-parent households with children. However, most of this difference is attributable to differences in household income, household size, education, and education and work force status of female heads. Small household size, low income, and low education levels are characteristics often associated with female-headed households. Female-headed households are less likely to purchase fruits, other meats (frankfurters, lunchmeats, lamb, and game), and fats and oils, and spend less on other meats compared with similar two-parent households. Female-headed households may allocate their income differently than two-parent households because: (1) there is no male head to influence food consumption patterns and food spending decisions; and (2) women may exhibit different preferences than men about allocating incomes to food. The finding that female-headed households spend less for food than do two-parent households in no way implies that female-headed households have lower nutrition. Although lower food expenditures may result from purchasing less food, or food of lower nutritional value, they may also result from buying less of costlier foods (such as convenience or fast foods), paying lower prices, or a combination of the above. Additional research is needed to investigate how differences in food expenditures translate into actual intake of food and nutrients for these two types of households. Female-headed households constitute a growing proportion of the total population, particularly of the population receiving food assistance. Female-headed households represented 24 percent of all family groups with children in 1988, but they made up nearly half of all households receiving food stamps. Approximately a third of the participants in the Women, Infants, and Children Program (WIC), one of several food assistance programs, lived in households with no adult male present. Identifying the causes for lower food expenditures among female-headed households should help programs aimed at increasing food expenditures among female-headed households. The data for this study were derived from the diary portion of the 1988 Continuing Consumer Expenditure Survey (CCES) of the Bureau of Labor Statistics (BLS), U.S. Department of Labor. The ERS report is Food Spending in American Households (by Elizabeth Frazao, ERS, TB-1806, July 1992, 55 pages).

- Number of New Items Offered in Retail Food Stores Doubles in Past 6 Years

In 1991, manufacturers introduced more food products--12,398--than ever before in our Nation's retail food stores. The 1991 total reflected a 20-percent increase over the 10,301 food products introduced in 1990, and more than doubled the introductions in 1985. This growth occurred despite 1990 and 1991 being recession years, with food sales rising less than food prices. In recent years, food processors have introduced food products in response to health concerns. In 1991, 5,800 new food products advertised health claims, more than three times the number in 1988. For further analysis, see "Record Number of New Products in 1991" (by Anthony E. Gallo) in Food Review (ERS, 15:2, July-September 1992).

- Advertising and Demand for Fluid Milk and Cheese

ERS conducted research on the effects of advertising and promotion on the demand for fluid milk and cheese. During the 80-month period between September 1984 and June 1991, the National Dairy Promotion and Research Board and regional organizations expanded generic advertising by $47.1 million for fluid milk and $263.1 million for cheese. The increased advertising expenditures raised fluid milk sales by about 7,455.4 million pounds. Sales of natural and processed cheese consumed at home rose by about 25 million pounds and 290 million pounds in the same period because of increased generic advertising.

2. Studies on Improving the Food Marketing System

- Local Produce in Local Stores

Produce managers and consumers liked having locally grown produce available, according to a study funded in part by AMS. The project was designed to provide access for local fruit and vegetable producers in local retail stores. There were 54 stores in the test area of Delaware, Maryland, and Virginia. Some 80 percent of the produce managers indicated that they purchased at least 33 percent more local produce during the project than before, meaning an increase of approximately $93,000 in sales for local farmers. It is unclear if conventional produce suffered at the expense of local production. In-store promotional materials and a 132-page guide identifying local products and producers were developed and proved useful for retail buyers.

- Marketing Organic Produce in Colorado

Obstacles to marketing fresh organic produce in Colorado supermarkets were identified in a study partly funded by AMS. Findings indicated that supermarket organic premiums are too high, the quality of organic produce is lower than that of conventional produce, and in-store handling affects organic produce quality. The study also identified supermarkets with successful organic produce sales, showing that it was feasible, practical, and profitable. Possible actions that could be taken by farmers, supermarket produce managers, and supermarket corporate warehouses were suggested. Numerous areas for further research were also listed.

- Precut Produce Promotes Sales

Washing, peeling, trimming, cutting, and chopping transform fresh fruits and vegetables into more convenient and accessible products for busy consumers. A study initiated by AMS indicates that significant potential exists to expand nationwide consumption of fresh produce through such value-added processing activities. This study of the dynamically new and growing fresh precut produce processing industry will provide a data base for produce firms entering the field, will aid planners concerned with job creation opportunities, and will develop good market outlets for locally grown produce produced by small and part-time farmers.

- Fresh Produce Losses in Transit

Fresh fruits and vegetables experience losses in the marketplace that are caused by mechanical injuries. Such losses due to transit vibration were studied in a joint venture by AMS and ARS. They looked at the acceleration levels and vibration frequencies that occurred during shipment of perishables in refrigerated trailer trucks equipped with different types of suspension systems. Conclusions suggested types of produce transport to use and how to improve suspension systems.

- Herbs Flavor the Southwest

The domestic herb market was studied by the Arizona Department of Agriculture and the Arizona Herb Growers and Marketers Association with partial funding from AMS. It was determined that 15 cities across the country had a total annual market activity of nearly 13 million pounds of fresh herbs and spices in 1991. California and Texas were the only States furnishing fresh herbs and spices to these cities. Work will continue to identify the users of herbs and spices and to determine Southwest regional demand and marketing opportunities.

- Cooperative Markets Serve Inner-City Shoppers

A large number of different kinds of independent food retailers located in a single location or building can provide inner-city consumers with a variety of products equal to or exceeding the diversity provided by major chain stores. Such cooperative retail markets often draw local producers from within a 100-mile radius and offer them a unique marketing outlet. AMS is helping the North Market Development Authority develop plans to expand such a market in Columbus, Ohio. Information developed in this project will also provide a planning basis for similar efforts in other cities and a benchmark for comparison with other inner-city food retailing efforts.

- Improving Farmers' Markets in Ohio and Missouri

Farmers' markets give consumers direct access to farm-fresh products, provide small farmers with a unique outlet for their products, and serve as sites for WIC demonstration sales points. Improving and increasing grower and consumer use of an existing farmers' market facility in Toledo, Ohio, is the goal of a project being done cooperatively by AMS, the Ohio State University Cooperative Extension Service, the Toledo Department of Natural Resources, and the Toledo Warehouse District Association (a nonprofit public group). AMS is also helping to develop designs for new farmers' markets in Columbus, Ohio, and Springfield, Missouri--facilities to replace previously successful markets that had been displaced by other development and moved to temporary quarters.

III. Nutrition Education and Information Programs

The Human Nutrition Information Service coordinates Federal dietary guidance policy, develops research-based dietary guidance materials for the general public, and reports results from its research in food composition, food consumption, and nutrition education to professionals.

The Cooperative Extension Service (CES) is a public-funded, nonformal, educational system that links the education and research resources and activities of the U.S. Department of Agriculture, 74 land-grant universities (located in all 50 States, 6 territories, and the District of Columbia) and 3,150 county administrative units.

The CES is a dynamic, ever-changing organization pledged to meeting the country's needs for research, knowledge, and educational programs that will enable people to make practical decisions. Its mission is to help people improve their lives through an educational process that uses scientific knowledge focused on issues and needs.

The Food and Nutrition Service mission is to alleviate hunger and to safeguard the health and nutritional well-being of the Nation through the administration of nutrition education and domestic food assistance programs. As a component of administering 14 domestic food assistance programs with a total FY 1992 budget of $33 billion, FNS is the largest Federal funding source for nutrition education. FNS provides grants to States and Indian Tribal Organizations for nutrition education in the WIC Program and the Child Nutrition Programs, and provides matching funds for nutrition education in the Food Stamp Program. FNS also develops nutrition education materials for use by food assistance program operators and provides technical assistance for the nutrition education components of sponsored programs.

A. USDA's Responsibility To Ensure That the Federal Government "Speaks With One Voice" When Issuing Dietary Guidance

• Promotion of the Food Guide Pyramid

The Food Guide Pyramid released by USDA in April 1992 has been overwhelmingly well received by the professional community and the public. The Food Guide Pyramid publication explains in detail to consumers how to follow USDA's food guide developed in the early 1980's. Fifty thousand copies of this publication and 100,000 posters were distributed to nutrition professionals, extension home economists, teachers, and consumers by HNIS. A condensed version of the 32-page "Food Guide Pyramid" booklet entitled, "The Food Guide Pyramid...Beyond the Basic 4," was developed by the Food Marketing Institute (FMI) in cooperation with USDA. Twenty thousand copies each of a colored 8-panel brochure and a black-and-white reproducible were distributed to nutrition professionals by HNIS. FMI distributed the brochure to supermarkets throughout the Nation for dissemination to consumers. A number of public and private sector groups are promoting the Food Guide Pyramid. The Education Department of the National Livestock and Meat Board has produced a pyramid poster for teachers and health professionals with reproducible panels for making handouts. The 5-A-Day Program sponsored by the Produce for Better Health Foundation in cooperation with the National Cancer Institute has included the pyramid in some of its newsletters. The 70th Anniversary issue of the trade publication Milling and Baking News published an entire full-color issue on the Dietary Guidelines and the Food Guide Pyramid, its development, and its promotion. The Metropolitan Life Foundation has published a booklet built around the pyramid, "How to Steer Your Family to Healthy Eating" which is part of Met Life's nutritional campaign with its ongoing public health education programs. The American Medical Association (AMS) will be replacing the "Four Food Groups" with the pyramid in the next textbook editions that they print. In a cooperative effort with the Society for Nutrition Education, McDonald's Corporation is including the pyramid in a series of public service announcements aired on Saturday morning on CBS TV. They have also developed a nutrition brochure and a teachers' guide that accompanies a 20-minute video. The pyramid graphic is being widely used by the media in newspaper and magazine articles, by the food industry on labels and in promotional materials, and by the schools in textbooks and curricula. The Department is aware of about 5,000 magazine and newspaper articles published since April 1992. The Pyramid has also been featured in many television and radio news stories. The announcement of the release of the Pyramid was covered on all the major television networks. The media have been very instrumental in helping acquaint consumers with the Pyramid.

• WIC Program Nutrition Education Grows as Participation Increases

Participation in the WIC program includes a minimum of two nutrition education contacts for each certification period, which lasts 6 months for most participants. The number of individuals receiving nutrition education through WIC during 1992 increased concurrent with an increase in the average monthly participation during 1992 by almost 0.5 million women, infants, and preschool children. Average monthly WIC participation for FY 1992 was 5.4 million.

• Dietary Guidance Outreach Activities

The Human Nutrition Information Service cooperated in a major USA WEEKEND-sponsored project in developing food and nutrition makeovers for 5 families selected from over 1,200 applicants nationwide. Included were hands-on learning activities on the Food Guide Pyramid and Dietary Guidelines-related topics, as well as results of dietary analyses of family members and original family recipes revised to follow Dietary Guideline principles. The USDA-developed makeovers were featured in a mid-November 1992 issue of USA WEEKEND which reaches a readership of 32 million individuals, thus offering USDA a unique opportunity to promote Dietary Guidelines messages to a large segment of the population.

• Cooperative Projects With the Private Sector

Several projects have been undertaken with FMI: (1) The condensed version of the 1990 edition of the Dietary Guidelines for Americans developed by HNIS, DHHS, and FMI in 1991 was revised to include the Food Guide Pyramid developed by HNIS. In addition to copies distributed by FMI, 20,000 copies each of an 8-panel color brochure and a black and white reproducible were distributed by HNIS to the nutrition community; (2) A Spanish translation of the condensed version of the Dietary Guidelines for Americans is available; (3) The condensed version of the Food Guide Pyramid publication--an 8-panel color brochure and a black and white reproducible master--was released in July 1992. The HNIS distributed 20,000 copies each of these publications to nutrition professionals.

HNIS worked cooperatively with the Association for the Advancement of Health Education to develop a teachers' kit for health educators to teach Dietary Guidelines concepts to junior and senior high school students.

B. Programs Initiated or Expanded

1. Food and Nutrition Service programs

- Nutrition Education Projects in the Food Distribution Program on Indian Reservations (FDPIR)

For FY 1993, FNS requested and Congress appropriated $135,000 for nutrition education for FDPIR. The money was allocated to each region based on FDPIR participation figures. FNS regional offices may use the funds to conduct nutrition education projects at the regional office level or solicit proposals from Indian Tribal Organizations and State agencies interested in conducting nutrition education initiatives. All proposals must include the following: (1) a line item budget; (2) a project description, including start and completion dates and the method of delivering nutrition education; and (3) a description of the evaluative component.

- National Food Service Management Institute

Public Law 101-147 and Public Law 102-337 authorized the establishment of the National Food Service Management Institute through FY 1994 at the University of Mississippi to improve the quality and operation of Child Nutrition Programs through training, technical assistance, research, and management support for child nutrition foodservice programs. Funding for FY 1990, was set at $500,000, with appropriations of $1.143 million for FY 1991, and $1.322 million for FY 1992. Now in its third year of operation, the Institute has provided educational opportunities through satellite programming, established a network of professionals, developed videos and materials presented in training sessions at American School Food Service Association's (ASFSA) national convention, conducted national conference workshops on procurement and feeding children with special needs, and conducted research projects to support training needs.

- Implementation of the Dietary Guidelines for Americans in the Child Nutrition Programs

As a first step in assisting program cooperators to put the Dietary Guidelines into practice, USDA, together with the Department of Health and Human Services, published Building for the Future, Nutrition Guidance for the Child Nutrition Programs. Over 475,000 copies have been printed and distributed to program cooperators. Work has been initiated to analyze the current National School Lunch Program (NSLP) meal pattern to determine if it is adequate to meet the nutritional goal of one-third of the 1989 Recommended Dietary Allowances for key nutrients and the 1990 Dietary Guidelines for fat and that it meets appropriate calorie levels. A Request for Proposal is also being written for the development and standardization of additional quantity recipes for the NSLP which will meet meal pattern requirements and reflect the new dietary guidelines. FNS is also planning to initiate a demonstration trial of a nutrient-based menu planning system. This alternative approach to menu planning requires that school meals meet a specific nutritional standard, e.g., 1/3 of the RDA's, rather than a food-based meal pattern. The meal planner has the flexibility to plan meals for a specified menu cycle and then analyzes the nutrient content of all the foods to be served during that cycle. Adjustments are made to individual menus as needed to insure that, on average, the one-third RDA goal is maintained during the cycle. In support of this development and to help school foodservice personnel conduct accurate nutrient analysis of menus and recipes, FNS has signed an Interagency Agreement with the HNIS to develop a National Nutrient Data base for the Child Nutrition Programs. This data base will be used by the software industry to develop nutrient analysis and foodservice software systems specifically for use in the Child Nutrition Programs.

- Nutrition Education Demonstration Grants

The Demonstration Grants are intended to support the development, implementation, and evaluation of innovative community nutrition intervention programs directed to Food Stamp Program participants. The projects will demonstrate how to enhance Food Stamp Program participants' knowledge of nutrition and skills that contribute to nutritionally sound diets and a healthy lifestyle. Educational objectives will focus on improved knowledge, abilities and skills in meal planning, budgeting, and food preparation skills. Projects funded under this program will be designed to provide measurable benefits, including improved nutritional behavior, targeted to those enrolled in the Food Stamp Program. FY 1993 funding was $500,000.

2. Extension's Expanded Food and Nutrition Education Program

a. General

The Expanded Food and Nutrition Education Program (EFNEP) is a unique program designed to reach limited-resource audiences -- especially youth and families with young children. EFNEP operates in all 50 States and in American Samoa, Guam, Micronesia, Northern Marianas, Puerto Rico, and the Virgin Islands. Extension professionals train and supervise paraprofessionals and volunteers who teach food and nutrition information and skills to limited-resource families and youth.

The objectives of the EFNEP are to assist limited- resource families and youth in acquiring the knowledge, skills, attitudes, and changed behavior necessary for nutritionally sound diets, and to contribute to their personal development and the improvement of the total family diet and nutritional well-being.

For FY 1991, EFNEP received approximately a 3 percent-increase in funding. With these increased dollars, the program reached 12.3 percent more families (232,178 in FY 1991 versus 206,657 in FY 1990). In FY 1991, 482,586 youth participated in 4-H EFNEP compared to 434,823 in FY 1990, an increase of 11 percent. Also, the program has shown increases in participation because of increased work with groups.

Participants were reached by direct teaching contacts by 2,151.1 full-time equivalent (FTE) paraprofessionals. This represents an increase of 14.3 participants per paraprofessional over the 1990 levels. In addition, 54,163 volunteers worked 466,018 hours (FTE of 224). At a minimum dollar value of $5 per hour, the value of volunteers working in the EFNEP program in 1991 amounted to $2,330,090.

States have given more attention to the number of hours of instruction and the time period for enrollment. Supervision and management by State staff have provided support for more frequent visits. This has resulted in shorter enrollment periods. States mention timeframes of 3-6 months or less than 12 months. Of all graduating homemakers in 1991, 84 percent graduated in less than 12 months. States also report an increase in graduation rate and increased workloads per FTE paraprofessional.

States reported conducting concentrated staff development and training in how to teach in small groups, also more volunteer training of teachers in schools. States also reported the development and use of video tapes for staff training purposes, as well as visual materials for teaching participants.

All States report an increase in cooperation with other agencies and private groups in order to implement the program in a more efficient manner. Most States have established referral systems with other Federal food assistance programs such as WIC and Food Stamps. Other public and private groups include Indian reservations, Head Start, schools, Foster Care, Boys & Girls Clubs, Commodity Foods, State departments of education, health departments, battered women's groups, single parents' groups, YMCA, YWCA, Chicanos Por la Causa, Adult Basic Education, Salvation Army, and Teen Parent Programs. Many persons are recruited from these programs into EFNEP, and many persons are referred to these programs or are made aware of these programs by EFNEP. All States report the use of a standardized curriculum, with the majority using **Eating Right Is Basic** (ERIB2) in both the adult and youth phases. An EFNEP family participant completes 12-20 lessons in a standard curriculum before graduation from the program. Participants learn topics such as food safety, choosing healthy foods, meal planning, food storage, and sanitation. Youth programs also include topics such as fitness, avoiding substance abuse, and home safety for latchkey children. In addition to ERIB2 or another curriculum, some States have developed special lesson series to meet the needs and interests of certain audiences, such as pregnant teens and latchkey children.

A variety of methods were used to monitor improvement in diets, nutrition knowledge, food behavior practices, and (in a few cases) health indices of homemakers and youth. Methods included Surveys I and II from the Eating Right Is Basic (ERIB-2) curriculum, computer dietary analysis, counting servings from the food groups, and birthweights of infants born to EFNEP mothers.

Upon entry into EFNEP, a 24-hour food recall disclosed that 48 percent of homemakers in a sample group had a diet with one or more servings of each of the food groups. Moreover, only 5.5 percent of the homemakers in the sample group had a diet with two or more servings of milk and meat and four or more servings of vegetables/fruit and bread/cereals. Upon graduation, 86 percent of the homemakers in a sample group had a diet with one or more servings of each of the food groups, and 35 percent of the sample were eating the minimum recommended number of servings from each food group.

b. Program Highlights

Each year more than a quarter million infants are born low birthweight (under 5 pounds 8 ounces). Low birthweight is most strongly associated with infant deaths that occur in the neonatal period or first month of life. Inadequate nutrition among pregnant women may account for as much as 57-65 percent of babies born with low birthweight. The risk of low birthweight is higher for women who are poor, black, younger than age 17, have little or no prenatal care, and have inadequate diets and gain less than 20 pounds during pregnancy. In the past 3 years, many States have placed an increased emphasis on working with low-income pregnant and parenting teens and adults at risk of low birthweight to help improve their prenatal and postpartum diets and, therefore, decrease the incidence of low birthweight and improve healthy births and infant nutrition. Programs such as "Have a Healthy Baby" in Indiana, "Great Beginnings" in New Hampshire, and "Teen-age Mothers" in Georgia have been developed and are being implemented. Initial evaluation data are showing improvements in birth weights of babies and improved health practices of mothers.

Alabama reported that one-half of the 4,137 Today's Mom participants were teens. In a sample group of 789, an average birthweight of 7 pounds 2 ounces was found. An average prenatal weight gain of 30 pounds was self-reported by the mothers.

Nevada reported that pregnant teens in their program gained an average of 28 pounds, which is near the recommended weight gain of 35 pounds, and the average birthweight was 6.96 pounds. In addition, Nevada reported that the percentage of teens breastfeeding from at least 3 to 6 months was 34 percent, which is well above the 15 percent national average for teens.

Indiana reported that, of the 356 women in their Have A Healthy Baby Program that delivered, 96.6 percent (344) had babies born at normal birthweight. In Puerto Rico, of the 252 babies delivered to young pregnant mothers in the EFNEP program, 92 percent (232) were normal birthweight.

Other reported successes include:

Arkansas estimated that 1,966 homemakers decreased the dollars spent for food at a savings of $135 per family ($269,620). Behaviors adopted by 1,361 families on food recalls and food behavior scores resulted in an estimated economic improvement of $806,702. Arkansas also estimated that 466 youth involved in food production and preservation provided an economic savings of $64,566 to their families.

Delaware reported that, upon program entry, less than 2 percent of participants consumed the recommended servings from the four major food groups. Upon program exit, 77 percent consumed the appropriate servings. At entry, 51 percent consumed dairy products, and at program exit, 99 percent consumed dairy products.

With Federal EFNEP dollars remaining relatively static over the past several years many States are seeking outside funding to help finance their EFNEP programs.

Indiana received a total of $235,000 in grants to expand its "Have a Healthy Baby" program to reach pregnant adolescents and to pilot-test a special program for limited-resource audiences. It has titled that new effort EFNEP PLUS for the addition of parenting and money management to the basic EFNEP food and nutrition curriculum.

Two Iowa counties have reported receiving grants. Polk County is in its tenth year of a grant from the Board of Supervisors to teach nutrition at the Commodity Supplemental Food Site. Black Hawk County, in cooperation with the Cedar Valley Food Bank, received a $10,000 grant from Ronald McDonald Children's Charities to implement a nutrition education program at the food bank.

In Massachusetts a proposal was developed by EFNEP and submitted to Job Training and Employment Corporation (JETC) to conduct an Occupational Training Program for Public Welfare recipients who would be hired to work in the New Bedford EFNEP site. The proposal Stated that four of the six individuals being trained would be hired as nutrition assistants in EFNEP. The total amount awarded was $17,363.

Minnesota received several grants: a 2-year grant to integrate parenting skills into the EFNEP program in 5 rural counties; a 3-year grant to develop and educate a low-literacy cardiovascular intervention for EFNEP audiences--this is a collaboration with the University of Minnesota's School of Public Health. In addition, several local businesses and agencies in one rural county donated $3,800 in cash as a local "match" to continue receiving EFNEP funding.

New Hampshire received a $19,000 grant from USDA's Food and Nutrition Service for nutrition education to food stamp recipients and food stamp eligible people. A $27,000 grant entitled "Safe or Sorry: A Food Safety Training and Educational Program for At-Risk Populations" was awarded to EFNEP by USDA Extension Service to focus on food safety for the most vulnerable populations: infants, preschool children, pregnant women, and those who are immuno compromised.

Wyoming received a grant from USDA Food and Nutrition Service to provide for two paraprofessionals to work on the Wind River Reservation. The paraprofessionals will teach tribal members how to make better use of commodity foods, how to prepare nutritious meals, the importance of eating a balanced diet, and how to alter recipes for better health.

3. Ongoing Food Safety and Quality Programs in the Cooperative Extension System

- National Initiative for Food Safety Education

Through the Food Safety & Quality Initiative, the Cooperative Extension System is working toward the goal of improving the ability of all components of the food system (food producers, processors, distributors, retailers, the food service industry, and consumers) to make informed, responsible decisions related to food safety and quality issues and practices.

States and counties determine target audiences based on their specific needs. The educational objectives for these clientele in Extension food safety and quality programs are:

-Adoption of recommended food handling and preparation practices to reduce the potential of foodborne illness.

-Improvement of practices and processes that promote the production and protection of a food supply with minimal risk from environmental contaminants, including bacteria and naturally occurring toxins, and from drugs and chemical residues.

-Increased understanding and application of Total Quality Management (TQM) practices, including Hazard Analysis and Critical Control Points (HACCP) and Quality Assurance (QA), to agricultural/aquatic production and food processing, preparation and service operations.

- Improved understanding of risks and responsible practices in relation to food and health through increased knowledge of:
  - Relative risks within the broad context of production and processing decisions, nutrition, and consumer concerns about health and the environment.
  - Agricultural/aquatic production practices and technologies and impacts on safety and costs of food products.
  - Food safety laws, agency responsibilities, regulations, and monitoring activities.
  - Risk assessment methodologies, assessment findings, and risk management decisions on the approval of drugs and chemicals and the relationships between health and the food supply.
  - Food components including nutrients, naturally occurring toxins, additives, contaminants, and microorganisms.
  - Food processing technologies, including food irradiation, modified atmosphere packaging, refrigerated foods with extended shelf life, etc.

Interdisciplinary food safety teams and programs at regional, State, and district or county levels are in operation in most of the country. Regional food safety task forces have been organizing and defining their objectives and/or projects. The Extension rapid response system for notifying States of time-sensitive information is utilized frequently for major alerts to media attention on food safety issues, such as the foodborne illness outbreak with a variant of *E. coli*. This system allows States to be prepared with educational messages for public inquiries and to take advantage of opportunities for education.

The FY 1992 Congressional appropriations for ES-USDA contained $1.5 million to fund the development of food safety and quality programs and to update and improve the Food Animal Residue Avoidance Databank (FARAD). Thirty model programs addressing six priority areas were funded in both FY 1991 and FY 1992. The projects have concentrated resources toward and produced up-to-date curricula or educational methods in: (1) food handler training, especially for those who serve high-risk individuals and who have limited resources for training; (2) risk education with youth and adults; (3) enhanced utilization of the FARAD in educational programs; and (4) model HACCP and TQM programs in agricultural production and food processing and retailing. Project results and materials are being shared nationwide, both within and outside the CES.

These and other programs have also resulted in much coalition-building and shared programming with other agencies and organizations. Cooperators typically include State and local departments of health, agriculture, human resources, education and human services; commodity and trade associations; medical schools and associations; and industry. In addition, where geographically possible, they may include regional or field staff of other Federal agencies. The cooperation varies from serving on task forces to joint training and educational programs. The most frequently mentioned benefits are improved coordination and communications. Also frequently mentioned is greater resources for programs.

- Keeping Food Safe in Colorado

During March and April 1992, 136 dietary managers, dietitians, nurses, volunteers, and Extension agents participated in the SAFE (Safety and Food Excellence) educational program for leaders. Participants were trained to present action-oriented programs on safe food handling to foodservice workers and caregivers of persons with reduced immune functions, including the elderly and chronically ill. Mean knowledge of key safe food handling practices increased as a result of the program. A 3-month follow-up indicated that an additional 297 foodservice workers and caregivers had been trained in that time period alone. Eighteen of 20 of the original participants also were achieving their behavioral goals for improved practices most of the time. The program is being implemented in several other Western States and has been adapted for training child care providers in northeastern Colorado.

- Florida Responds to Hurricane Andrew With Safe Food Handling Help

Florida worked with other organizations and agencies to provide immediate education and information on safe food handling to residents affected by Hurricane Andrew in August, 1992. Much information on food and water safety was provided in multilingual publications (English, Spanish, and sometimes Creole and French).

- Other High-Risk Audiences Educated in Florida

Persons with HIV infection, cancer patients, parents with infants less than 1 year old, foodservice workers in nursing homes, and dietitians were educated on ways to reduce foodborne illness for compromised individuals. Different educational materials--several print publications and video--were compared and the print materials were more effective in improving knowledge of safe food handling practices.

4. Ongoing Nutrition Education Programs in the Cooperative Extension System

The Cooperative Extension System is currently planning a "Food Security Public Issue Education Workshop." The objectives of the workshop are to enhance Extension educators' awareness about food security and hunger issues, providing them with an opportunity to increase their understanding of the processes of public issue education. The workshop will focus on several areas: (1) helping participants enhance their ability to work in public policy education; (2) increasing their awareness of societal issues that impact on, or are related to, food security; (3) improving their knowledge and skills in addressing the broad related issues of hunger/food security through public issue education; (4) learning more about emerging leadership models which have implications for public issue education; and (5) increasing their knowledge of different approaches to conducting public issue educational programs.

5. National Agricultural Library (NAL) Programs

The Food and Nutrition Information Center (FNIC) is staffed by nutritionists and dietitians and serves all persons seeking information or materials in the area of food and human nutrition. The Center is located at NAL in Beltsville, MD. In FY 1992, FNIC answered over 4,500 in-depth reference questions, responded to an additional 6,500 requests for publications, and worked with 250 onsite visitors to the Center. The FNS supported NAL again this year with an $110,000 interagency agreement, which provides FNS program professionals throughout the country with free access to data base searches and other information services as well as free document delivery services for journal articles and educational materials.

• Trust Fund Cooperative Agreement With the University of Mississippi National Food Service Management Institute (MNFSMI)

FNIC continues work with the Institute to provide access to information and document delivery services concerning nutrition and food service management. The NAL receives $45,000 annually from the Institute for the services provided. FNIC and the MNFSMI are linked through an extension to a toll-free number located at the University of Mississippi. Users are able to dial toll-free to receive personal reference service from a nutritionist working for the Institute but located at FNIC in Beltsville, MD; and to receive free document delivery services from NAL.

Interagency reimbursable agreement with the FDA, NAL, FDA, and the FSIS began in late FY 1992 to establish a food labeling education information center and data base located at the FNIC. Staffed by one information specialist who works closely with other FNIC personnel, the center began maintaining a data base of all materials, activities, programs, research, etc., related to food labeling education developed by both the private and public sector. FDA provided $55,125 in FY 1992. Center staff will be actively involved in the National Exchange for Food Labeling Education, a national network of individuals, private sector organizations, and public sector agencies working with all aspects of food labeling education.

• New Bibliographies/Information Products

The following bibliographies and resource lists were published in FY 1992: Cultural Perspectives on Food and Nutrition, Food Service Management: Audiovisuals and Printed Materials, Nutrition Education Printed Materials and Audiovisuals: Grades Preschool - 6, Nutrition Education Printed Materials and Audiovisuals: Grades 7-12, Food and Nutrition Microcomputer Software List, Sources of Free or Low-Cost Food and Nutrition Materials, Merchandising School Food Service: Articles and Training Materials, Implementing the Dietary Guidelines in School Food Service: Articles and Training Materials, Selected Self-Improvement and Management Audiotapes in the FNIC Collection, and Models and Replicas in the FNIC Collection.

FNIC publications are now available on floppy disks and on ALF, the NAL's electronic bulletin board.

• National Microcomputer Software Demonstration Center

The Software Demonstration Center is a one-of-a-kind service provided at FNIC for free use by educators, health professionals, consumers, software developers, etc., who may come to the Center to use the software. On-site assistance is provided by a nutritionist. Public and private sector software producers have donated over 180 personal computer software programs, demonstration disks, and CD-ROM's to FNIC. Subject coverage includes: dietary analysis or diet planning, nutrition education, food service and planning management, health education, food technology, and recipes. Center users come from all parts of the country.

6. Agricultural Marketing Service Programs

• Fat-Lowering Changes in Lamb Grading Standards

In response to consumers' preference for leaner meat, the standards for grading sheep carcasses and live sheep were changed, effective July 6, 1992. Payment to producers will be more closely tied to the lean portion of the carcass rather than the fat. The most significant change is a requirement that lamb carcasses be identified for both quality grade (palatability indicators) and yield grade (lean to fat ratio) when officially graded. Another change requires that grades be applied to carcasses after removal of kidney and pelvic fat (which can be considerable in sheep) prior to weighing the carcasses for determining "dressed" yields, thus eliminating a major incentive for overfattening lambs. A third change eliminates "leg conformation" scoring. This change was based on USDA research findings that conformation (external shape) can be affected both by fat and muscle, and may not be a true measure of the ratio of "lean" in an animal.

- Select Beef Impacts the Meat Counter

"USDA Select" beef was over 20 percent of graded beef in 1992. This was up from two percent in 1987 when AMS changed the grade name "Good" to "Select."

- Commodities Tailored for the States Through State Option Contracts (SOC)

Through SOC, schools can receive more further processed items that add menu variety and reduce preparation costs, while AMS has more money available to support markets. AMS initiated this method of providing commodities to schools with a test purchase of chicken nuggets. The test proved so popular with the States that AMS intends to expand the program to livestock, fruits, vegetables, and other poultry commodities. Under SOC, States request that USDA purchase a specific further processed commodity, AMS buys the commodity via the normal procurement process, and States reimburse AMS for the further processing costs (the price difference between the raw material and the finished product). Only the price of the raw material would be charged against the State's entitlement.

- Low-Fat Beef Patties Bought for Schools

During the 1992 school year, AMS purchased low-fat beef patties and distributed them to schools. Two formulations were selected: beef with oat bran/fiber and beef with carrageenan (a naturally occurring plant substance). The added ingredients help to maintain juiciness which would otherwise be lost when the low-fat patties are cooked. AMS had made a test purchase of similar patties in 1991 and the product was well received by the schools.

- Lower Fat Level in Ground Beef

The maximum fat level permitted in bulk ground beef and in ground beef patties that AMS will buy for schools was reduced from 22 percent to 21 percent.

- Poultry Adds Variety to School Menus

Test purchases of two poultry products--low-fat turkey burgers and fully cooked, individually-frozen diced chicken meat-- were successfully completed and both programs will be expanded in future school years. These convenient products were well received by students and school food service personnel alike.

C. Nutrition Education and Information Highlights

- The Nutrition, Education and Training (NET) Strategic Plan

The Nutrition and Technical Services Division of FNS initiated a Strategic Planning Process for the NET Program with a conference in March 1992. From the strategic planning process. The Strategic Plan evolved with a philosophy Statement which describes the scope and benefits of the NET Program's organizational purpose. The Strategic Plan outlines measurable program objectives which detail what NET is trying to achieve by the year 2000. The document also identifies major strategies and specific tactics to promote healthy eating for our Nation's children. The plan should be used as guidance by Federal and State planners to develop and implement NET Programs and to provide nutrition education services to the Nation's children, their parents, their caregivers, and food service personnel.

- Nutrition Education Fliers and Poster for the Food Distribution Program on Indian Reservations (FDPIR)

This series from FNS consists of 12 fliers, each presenting a basic lesson about a health and nutrition issue that concerns recipients of FDPIR. These focus on specific diet-related health conditions that afflict a larger proportion of Native Americans than the general population, such as diabetes, heart disease, hypertension, and obesity. The fliers also address topics such as special nutritional needs during pregnancy, improved food preparation techniques, and eating habits, with a strong emphasis on the healthy use of USDA commodities. Each flier also includes recipes appropriate to the topic it addresses. Every month beginning toward the end of the first quarter of FY 1993, one of the fliers will be issued along with the FDPIR food package. A poster to aid in the promotion of the series has also been developed. Posters will be displayed by programs at commodity distribution points and certification sites to inform recipients and create interest in the series.

- Small Grants for Food Stamp Studies

The purpose of the Small Grants for Food Stamp Studies project is to complement and extend the main research agenda of FNS, through gaining the benefit of a wide range of scholarly thinking on the basic program, policy, and research issues currently or potentially facing the Food Stamp Program. Problems of nutrition education of Food Stamp recipients and other low-income households, with special emphasis on skills of economizing while making nutritious food choices, are one of several important issues that may be addressed by applicants for these grants which were awarded for three alternative cost ranges in 1992: (1) up to $25,000; (2) up to $50,000; and (3) up to $100,000.

• Nutrition Education Matching Funds Grants

Food Stamp Program administrative matching funds are provided for State-initiated nutrition education plans conducted exclusively for the benefit of Food Stamp applicants and participants, and do not duplicate USDA's EFNEP efforts in the States. The plans submitted by the States must be approved by the FNS Regional Office for matching funds. Contributions from private agencies and institutions cannot be included in the State match for the nutrition education plan, although use of private donations and volunteer services is not discouraged. In FY 1992 seven States had nutrition education plans approved by FNS: New York, New Hampshire, Ohio, Minnesota, Wisconsin, Oklahoma, and Washington. There is diversity in the Food Stamp population targeted and the methodology of the nutrition education plans submitted annually. Each plan includes the description of the activities in the program, the number and positions of staff to conduct the nutrition education program, as well as a description of the targeted Food Stamp population. The matching Federal cost of the FY 1992 nutrition education plans was over $1,200,000.

• WIC/Extension Service Nutrition Education Initiative

The Department's FY 1993 appropriation included an increase of $3.53 million to the Extension Service to provide nutrition education to the neediest of WIC participants. Funds will be made available through formula funding to all States and through competitive awards for special projects. FNS and ES have collaboratived to develop the application requirements and evaluation criteria for the initiative.

• Breastfeeding Promotion Incentive Grants

FNS awarded grants in FY 1991 to identify barriers to breastfeeding and to develop or improve breastfeeding promotion services. Eight local WIC agencies (from the States of Arizona, Georgia, Kentucky, Michigan, North Carolina, and Utah) received approximately $100,000 in grants to study the effectiveness of using locally donated incentives to promote breastfeeding from October 1, 1991, through May 1993. These incentive projects are being developed to complement existing breastfeeding promotion and support activities. Incentive items or services, such as baby carriers and blankets, child care, and breast pumps, or points will be given to encourage behaviors which increase breastfeeding rates such as: (1) participating in educational sessions on prenatal nutrition and infant feeding; (2) enrolling in WIC; (3) keeping WIC and prenatal appointments; and (4) achieving various milestones in initiating and maintaining the duration of breastfeeding.

Regulations: It is anticipated that a final WIC rule establishing a national definition for the term "breastfeeding" and setting standards for the promotion and support of breastfeeding for WIC State and local agencies, pursuant to Public law 101-147, will be published early in FY 1993. A final rule enhancing the WIC food package for breastfeeding women to more effectively meet their nutritional needs and to support their decision to breastfeed will be published.

FNS Breastfeeding Mother's Room: FNS has established a breastfeeding mother's room at its headquarters location. This is a private place, equipped with an electric breast pump and refrigerator, where nursing employees can go to pump their breast milk and store it safely while at work, so that it can be taken home to their infants.

• Graduate Fellowships Grants Program Activitites--1992

The USDA Food and Agricultural Sciences National Needs Graduate Fellowships Grants Program was initiated in 1984 to attract academically outstanding scholars into advanced studies in the food and agricultural sciences. The program provides 3 years of training for a doctoral student in one of the following national needs areas where there is a shortage of expertise: food science/human nutrition; biotechnology; food, forest products, and agribusiness management and marketing; agricultural engineering; and water sciences.

The Fellowships Program has achieved a notable record and is proving to be an important part of the solution to the serious erosion of our Nation's scientific expertise. More than 600 fellows have participated in the program to date in prestigious graduate departments at both land-grant and non-land-grant universities. Twenty-three percent of the fellows have received support in the national needs area of Food Science/Human Nutrition.

Some examples of important breakthroughs in the research being done under this program include: (1) One student has been researching the antiobesity-antidiabetic actions of a naturally occurring steroid, dehydroepiandrosterone (DHEA), which produces estrogen and testosterone, two important hormones for both men and women. The hoped-for result of the research is the development of methods to increase the production of the steroid during adulthood, thereby increasing protection against developing obesity, diabetes, cancer, and elevated blood lipids; (2) Another student was able to show that the gene for obesity in obese Zucker rats is identical to that in obese rats of other strains and in obese mice. Other species will have to be examined, but since there is a cross species homology, it is hoped that such a gene can be found in humans, and then work can be done to find ways of preventing its expression.

In FY 1992, almost $3.4 million was available to fund the program. Twelve projects were selected for support from the 39 proposals submitted in Food Science/Human Nutrition. FY 1992 Fellowships Grants were awarded in the amount of $54,000 per fellow to each of the following institutions: University of Nebraska, Lincoln; The Ohio State University (two grants); University of Minnesota; Purdue University; North Carolina State University; Iowa State University; University of Wisconsin, Madison; Cornell University; University of Chicago; University of California, Davis; and The Pennsylvania State University. Project directors at these institutions will select 21 doctoral fellows for 3 years of support.

IV. Funding Levels (1986-93)

The actual expenditures for human nutrition research and human nutrition education and information by the several agencies in USDA for FY's 1986 through 1991 are summarized in Table 2. The estimate for FY 1992 and the congressional appropriation for FY 1993 are also included. The total amount of human nutrition research support increased 25 percent from $60.7 million in FY 1986 to $76.1 million in FY 1992. During the same period, support for human nutrition education and information rose 61 percent from $132.1 to 212.4 million. The total support for human nutrition research education and information in the congressional appropriation for FY 1992 was $288.5 million, or 50 percent more than was expended in FY 1986.

Table 3 shows the amount of human nutrition research support within the Department for this period by subject area categories and agency. Over half of the human nutrition research effort is focused on determining nutrient requirements/health maintenance at all stages of life. About one-sixth of the effort relates to the development of methods for measuring nutritional status and collecting food consumption information. Approximately one-sixth of the funds is used to measure the content and bioavailability of nutrients in foods. The funds shown in the table do not include those provided by the States or other sources and used in conjunction with funds provided by CSRS.

Funds available for competitive research grants in human nutrition through the National Research Institute Competitive Grants Program (NRICGP) were increased in the appropriation from $2.59 million in FY 1991 to $3.8 million in FY 1992.

Table 4 presents a breakdown of human nutrition education and information expenditures and budgets by subject category for the FY's 1986-92.

A summary of actual expenditures and estimated support and the congressional appropriation are given in Table 5 for the five Human Nutrition Research Centers and ARS other laboratories or centers for FY 1986-92. The net figure refers to funds to the location, while the gross amount includes overhead costs.

ARS operates the Center at Tufts University in Boston as a Government-owned, contract-operated (GOCO) facility. It operates the Center at Baylor College of Medicine in Houston is operated by ARS through a cooperative agreement.

Human nutrition research support at ARS Regional Research Centers and other laboratories is shown in Table 6. These studies help to ensure that problems and opportunities in human nutrition are considered in research directly related to the quality of the food supply.

Each year WIC State agencies must spend a minimum total for all States of $8 million nationwide for breastfeeding promotion activities. These expenditures must be made from States' WIC administrative grants (or other sources) and do not constitute additional Federal appropriations.

Table 2. U.S. Department of Agriculture Human Nutrition Research, Monitoring and Education Support (FY 1986-94)

Human Nutrition Research and Monitoring
($ in Millions)

Fiscal Year

	1986	1987	1988	1989	1990	1991	1992	1993	1994
	actual	actual	actual	actual	actual	actual	estimate	actual	estimate
ARS	37.8	0.6	44.3	45.7	47.9	49.6	49.9	49.7	50.1
CSRS	7.9	7.5	7.6	6.9	8.1	10.7	12.3	12.5	14.9
HNIS	12.8	.1	7.1	.7	7.9	8.5	9.0	6.7	11.4
ERS	0.7	1.2	1.0	0.9	0.9	1.1	1.1	1.5	1.5
FNS	1.5	0.5	0.5	0.6	2.8	2.3	3.8	5.1	4.7
TOTAL	60.7	5.9	60.5	61.8	67.6	72.2	76.1	75.5	82.6

Human Nutrition Education

	1986	1987	1988	1989	1990	1991	1992	1993	1994
ES	73.5	73.5	75.0	75.0	74.6	77.2	77.7	84.7	94.1
HNIS	0.7	0.7	1.2	1.1	1.1	1.4	1.3	1.2	1.2
FNS	57.0	60.4	65.5	71.6	86.6	98.7	132.6	148.0	161.0
FSIS	0.4	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1
NAL	0.5	0.4	0.5	0.7	0.7	0.8	0.7	0.7	0.7
TOTAL	132.1	135.1	42.3	148.6	163.1	178.2	212.4	234.7	257.1
TOTAL Research, Education, and Monitoring	192.8	191.0	202.8	210.4	230.7	250.4	288.5	310.2	339.7

Table 3. USDA Nutrition Research and Monitoring Support (FY 1986-93)

($ in Millions)

	Fiscal Year							
	1986 actual	1987 actual	1988 actual	1989 actual	1990 actual	1991 actual	1992 actual	1993 estimate
1. Nutrient Requirements/ Health Maintenance								
CSRS	3.7	4.8	4.2	4.0	4.2	6.0	6.2	6.2
ARS	27.5	29.9	31.0	33.3	37.7	38.1	39.4	39.4
TOTAL	31.2	34.7	35.2	37.3	41.9	44.1	45.6	45.6
2. Nutritional Status/ Food Intake								
CSRS	2.4	1.4	1.8	1.3	2.4	2.5	3.4	3.5
ARS	3.1	3.9	3.9	4.0	2.5	3.3	4.5	4.1
HNIS	9.9	3.2	3.9	4.8	4.9	5.4	5.2	3.0
FNS	n/a	n/a	n/a	0.1	n/a	n/a	n/a	n/a
TOTAL	15.4	8.5	.6	0.2	.8	11.2	13.1	10.6
3. Use of Food/Food Choices								
CSRS	0.2	0.3	0.2	0.3	0.3	0.3	0.3	0.4
HNIS	1.1	1.1	1.3	1.1	1.1	1.2	2.0	1.8
ERS	0.4	0.9	0.7	0.8	0.8	1.0	0.8	1.1
FNS	n/a	n/a	n/a	n/a	0.1	n/a	n/a	n/a
TOTAL	1.7	2.3	2.2	2.2	2.3	2.5	3.1	3.3
4. Nutrient Composition/ Bioavailability								
CSRS	1.6	1.0	1.4	1.2	1.2	1.8	2.4	2.4
ARS	7.2	6.8	9.4	8.4	7.7	8.2	6.0	6.2
HNIS	1.8	1.8	1.9	1.8	1.9	1.9	1.8	1.9
TOTAL	10.6	9.6	12.7	11.4	10.8	11.9	10.2	10.5
5. Nutritional Impacts of Programs								
CSRS	n/a	n/a	0.1	0.1	0.1	0.1	n/a	n/a
ERS	0.3	0.3	0.1	0.1	0.1	0.1	0.3	0.4
FNS	1.5	0.5	0.5	0.5	2.7	2.3	3.8	5.1
TOTAL	1.8	0.8	0.7	0.7	2.9	2.5	4.1	5.5
TOTALS								
CSRS	7.9	7.5	.7	6.9	.2	10.7	12.3	12.5
ARS	37.8	40.6	44.3	45.7	47.9	49.6	49.9	49.7
HNIS	12.8	.1	7.1	7.7	7.9	8.5	9.0	6.7
ERS	0.7	1.2	0.8	0.9	0.9	1.1	1.1	1.5
FNS	1.5	0.5	0.5	0.6	2.8	2.3	3.8	5.1
USDA Total	60.7	55.9	60.4	61.8	67.7	72.2	76.1	75.5

n/a = Not applicable.

Table 4. USDA Nutrition Education Support (FY 1986-93)

($ in Millions)

	Fiscal Year							
	1986 actual	1987 actual	1988 actual	1989 actual	1990 actual	1991 actual	1992 actual	1993 estimate
Extension Service								
Extension (Formula estimate)	15.9	15.9	16.4	16.4	16.4	16.7	17.2	17.9
Expanded Food and Nutrition Education Program (EFNEP)	57.6	57.6	58.6	58.6	58.2	60.5	60.5	60.5
Intensive Education for WIC	n/a	n/a	n/a	n/a	n/a	n/a	n/a	6.3
TOTAL	73.5	73.5	75.0	75.0	74.6	77.2	77.7	84.7
National Agricultural Library								
Food and Nutrition Information Center	0.5	0.4	0.5	0.7	0.7	0.7	0.7	0.7
Nutrition Education Initiative*	n/a	n/a	n/a	n/a	n/a	0.1	n/a	n/a
TOTAL	0.5	0.4	0.5	0.7	0.7	0.8	0.7	0.7
Human Nutrition Information Service								
Guidance and Education	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Research Branch	0.7	0.7	1.2	1.1	1.1	1.4	1.3	1.2
Food and Nutrition Service								
Nutrition Education & Training Program (NET)	5.0	5.0	5.0	5.0	5.0	5.0	10.0	10.0
Special Supplemental Food Program for Women, Infants and Children (WIC)	52.6	55.4	60.5	66.6	81.6	93.7	112.1	124.6
WIC Breastfeeding Promotion	n/a	n/a	n/a	n/a	n/a	n/a	8.0	8.0
Child Nut.Dietary Guidelines	n/a	n/a	n/a	n/a	n/a	n/a	n/a	2.0
Food Service Management Inst.	n/a	n/a	n/a	n/a	n/a	n/a	1.3	1.7
Food Stamp Households	n/a	n/a	n/a	n/a	n/a	n/a	1.2	1.2
Grants for New Ways to Reach Food Stamps Households	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.5
TOTAL	57.6	60.4	65.5	71.6	86.6	98.7	132.6	148.0
Food Safety and Inspection Service								
Nutrition Labeling	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Nutrition and Sodium Info.*	0.1	0.02	n/a	n/a	n/a	n/a	n/a	n/a
Sodium Monitoring Program*	0.2	0.01	n/a	n/a	n/a	n/a	n/a	n/a
FDA/FSIS Labeling Consistency*	n/a	n/a	n/a	0.1	n/a	n/a	n/a	n/a
TOTAL	0.4	0.13	0.1	0.2	0.1	0.1	0.1	0.1
USDA Total Nutrition Education	132.7	35.1	142.3	148.6	163.1	178.2	212.4	234.7

* Programs discontinued.
n/a = Not applicable.

Table 5. Agricultural Research Service Human Nutrition Research Support (FY 1986-93)

($ in Millions)

		Fiscal Year							
		1986 actual	1987 actual	1988 actual	1989 actual	1990 actual	1991 actual	1992 actual	1993 estimate
BHNRC	Gross	7.91	8.34	8.42	8.12	8.27	8.69	9.23	9.23
Beltsville, MD	Net	7.02	7.41	7.35	7.31	7.48	7.82	8.31	8.31
GFHNRC	Gross	6.36	6.66	7.11	7.03	7.29	7.70	8.07	8.07
Grand Forks, ND	Net	5.64	5.92	6.32	6.33	6.59	6.93	7.26	7.26
HNRCA	Gross	11.75	2.76	13.68	14.06	14.26	14.56	14.57	14.57
Boston, MA	Net	11.16	12.12	12.99	13.35	13.54	13.83	13.84	13.84
CNRC	Gross	4.43	5.43	7.65	9.07	10.43	10.43	10.70	10.27
Houston, TX	Net	3.93	4.88	6.99	8.34	9.63	9.91	10.17	9.76
WHNRC	Gross	3.66	4.23	4.49	4.46	4.67	5.02	5.11	5.11
San Francisco, CA	Net	3.25	3.76	3.95	4.01	4.22	4.52	4.60	4.60
TOTAL, HN Centers	Gross	34.11	37.42	41.35	42.74	44.92	46.40	47.68	47.25
	Net	31.00	34.09	37.60	39.34	41.47	43.01	44.18	43.77
Other ARS HN	Gross	3.65	3.18	3.01	2.96	2.96	3.19	2.25	2.47
Research	Net	3.24	2.86	2.65	2.66	2.67	2.72	2.03	2.23
TOTAL, Human	Gross	37.76	40.60	44.36	45.70	47.87	49.59	49.93	49.72
Nutrition	Net	34.24	36.95	40.25	42.00	44.14	45.73	46.21	46.00

Table 6. Other Agricultural Research Service Human Nutrition Research Support (FY 1986-92)*

($ in Thousands)

		Fiscal Year							
		1986 actual	1987 actual	1988 actual	1989 actual	1990 actual	1991 actual	1992 actual	1993 estimate
Beltsville, MD	Gross	n/a	n/a	128.7	121.8	116.8	125.1	n/a	n/a
	Net	n/a	n/a	111.8	109.6	105.6	106.7	n/a	n/a
Ithaca, NY	Gross	601.3	750.9	765.0	755.4	743.0	785.1	384.5	384.5
	Net	533.5	675.9	676.0	679.7	671.8	669.5	346.6	346.6
Wyndmoor, PA	Gross	667.1	303.1	n/a	n/a	n/a	n/a	n/a	n/a
	Net	591.9	272.9	n/a	n/a	n/a	n/a	n/a	n/a
Peoria, IL	Gross	985.5	982.4	1,017.5	1,007.1	1,068.1	1,144.2	738.4	738.3
	Net	874.5	84.3	898.8	906.3	965.8	975.8	665.6	665.6
Albany, CA	Gross	959.2	712.7	653.8	493.0	483.9	519.7	530.2	641.1
	Net	851.1	41.5	576.3	443.6	437.6	443.2	478.0	578.0
Hyattsville, MD	Gross	433.5	432.7	443.1	580.0	545.3	613.9	600.1	710.8
	Net	384.6	389.5	391.0	521.9	493.1	523.5	541.0	640.7
	Gross	3,646.6	3,181.8	3,008.1	2,957.3	2,957.1	3,188.0	2,253.2	2,474.7
	Net	3,235.6	2,864.1	2,653.9	2,661.1	2,673.9	2,718.7	2,031.2	2,230.9

* Excludes Human Nutrition Centers.

V. Coordination and Advisory Mechanisms

A. Coordination Within the Federal Sector

- Interagency Committee on Human Nutrition Research (ICHNR)

The ICHNR continued to coordinate human nutrition research activities at the Federal level under the leadership of co-chairpersons, Dr. Harry Mussman (January 1 to August 31, 1992), Acting Assistant Secretary for Science and Education, USDA; Dr Duane Acker (September 1 to December 31, 1992), Assistant Secretary for Science and Education, USDA; and Dr. James Mason, Assistant Secretary for Health, DHHS. Meetings were held twice with representatives from member departments and agencies as follows: Agency for International Development, USDA, National Aeronautics and Space Administration, Department of Commerce, Department of Defense, DHHS, National Science Foundation, Department of Veterans Affairs, and Office of Science and Technology Policy (OSTP). Scientific topics discussed at these meetings included stable and radioisotopes in human nutrition research and reference materials for food and nutrition. At the April meeting, followup activities conducted in relation to the stable and radioactive isotope needs for human nutrition research were discussed. The issues are at the highest level of OSTP and decisions about resuming production are expected.

A working group on reference materials for food and nutrition was established and it prepared recommendations related to nutrition labeling. The group addressed the issues of other reference material needs. The ICHNR considered the activity of the working group to be important and a proposal for establishment of a standing committee was encouraged.

The Sixth Conference for Federally Supported Human Nutrition Research Units and Centers was postponed from 1993 to 1994.

- Uniformity of Dietary Guidance Among Departments

The Department of Agriculture continues to work with other agencies, especially DHHS, in promoting uniformity of dietary guidance messages. For example, on behalf of USDA, HNIS coordinated with DHHS all activities of the Federal Dietary Guidelines Advisory Committee, the review of Committee recommendations in the two departments, and the development of final text for the third edition of the Dietary Guidelines for Americans. HNIS is represented on a DHHS Subcommittee on Dietary Guidance; on the Coordinating Committee for the National Cholesterol Education Program sponsored by the National Heart, Lung, and Blood Institute; on the Nutrition Objectives Working Group of the DHHS's Year 2000 Health Objectives; on the Interagency Committee on School Health co-chaired by DHHS and the Department of Education; and on the National Exchange for Food Labeling Education.

- Interagency Board for Nutrition Monitoring and Related Research

The Interagency Board for Nutrition Monitoring and Related Research is co-chaired by the USDA Assistant Secretary for Food and Consumer Services and the DHHS Assistant Secretary of Health. The Board includes members from all Federal agencies that conduct nutrition monitoring or related research and are major users of nutrition monitoring data and a liaison from the National Nutrition Monitoring Advisory Council. The Board is responsible for enhancing the effectiveness and productivity of Federal nutrition monitoring efforts by improving planning, coordination, and communication among agencies. Working groups under the auspices of the board are addressing issues in survey comparability; Federal-State relations, information dissemination, and exchange; and food composition data bases. Under the general direction of the board, the following reports and publications were produced in 1992:

-"Ten-Year Comprehensive Plan for Nutrition Monitoring and Related Research"
-"Directory of Federal and State Nutrition Monitoring Activities"
-Interagency Board for Nutrition Monitoring and Related Research Program brochure
-National Nutrition Monitoring Advisory Council brochure "Improving Comparability in the National Nutrition Monitoring and Related Research Program: Population Descriptors"

- Ten-Year Plan Interagency Implementation Working Group

HNIS co-chairs with DHHS the [illegible]-Year Plan Interagency Implementation Working Group, which includes staff from all involved agencies assigned to Ten-Year Plan activities. The group met twice in 1992 to discuss plans and approaches for specific activities and developed progress report documents for each of the activities in the Ten-Year Plan.

- Federal State Relations, Information Dissemination, and Exchange (STRIDE) Working Group

Federal STRIDE Working Group, co-chaired by HNIS and DHHS, is one of three working groups of the Interagency Board of Nutrition Monitoring and Related Research. Federal STRIDE develops, coordinates, and monitors procedures for improving communication with users of nutrition monitoring data and facilitates communication within the Interagency Board about individual member agency activities. The Working Group met three times in 1992. A marketing plan for the "Directory of Federal and State Nutrition Monitoring Activities" is under development. Federal STRIDE members gave numerous presentations on nutrient monitoring activities at various professional meetings throughout the year.

• Survey Comparability Working Group

The Survey Comparability Working Group, also co-chaired by HNIS and DHHS, is another of three working groups of the Interagency Board for Nutrition Monitoring and Related Research. This group prepares reports of its findings, highlighting similarities and differences among the surveys and surveillance activities and making recommendations for improving comparability in the NNMRRP. The group has met on over six occasions in the last 2 years. Population descriptors was the first area selected to be evaluated for comparability. A final report on "Improving Comparability in the National Nutrition Monitoring and Related Research Program: Population Descriptors" was developed. The report has been well received, with more than 250 copies provided to Federal, State, and academic researchers.

• Food Composition Data Working Group

The Food Composition Data Working Group, co-chaired by HNIS and ARS, is the third three working groups in the Interagency Board for Nutrition Monitoring and Related Research. This working group identifies and addresses issues related to food composition data bases as they are used for nutrition monitoring purposes. Their activities in 1992 centered around the Ten-Year Plan for Nutrition Monitoring and Related Research. The Working Group ensured that food composition data issues were appropriately addressed in the Ten-Year Plan, that work began on the food composition activities specified in the Plan, and that the activities were coordinated among the appropriate government agencies. Working group members also provided information to the National Nutrition Monitoring Advisory Council about developing the ability to perform trend analysis on dietary intake data.

• Federal Resource Committee for Determining the Federal Role Regarding Regarding Adequate Nutrition Education of Physicians

HNIS serves as the USDA representative to the Federal Resource Committee for determining the Federal role regarding adequate nutrition education of physicians. The Committee,led by DHHS, is providing technical guidance and expertise to DHHS as that department develops a report required by P.L. 101-445. The report is to describe the appropriate Federal role in assuring that students enrolled in U.S. medical schools and physicians practicing in the United States have access to adequate training in the field of nutrition and its relationship to human health.

• USDA Development of the Food Grouping System in Cooperation With EPA and FDA

HNIS, in cooperation with EPA and FDA, is developing a computerized data analysis system called the Food Grouping System. This system will separate foods, as they are reported to be consumed, into their component parts (ingredients) and allow these parts to be regrouped to meet the needs of users. For example, total tomato consumption including tomatoes on pizza and in soup and sandwiches will be determined for specific population groups. HNIS has worked with EPA and FDA since the earliest planning phases of the project to assure that the system will meet those agencies needs, particularly in regard to food safety.

• Pesticide Data Program

The Pesticide Data Program (PDP) is a comprehensive, multi-agency program to collect and analyze pesticide use and residue data regarding actual concentration levels in food. The PDP is administered by four USDA agencies--AMS, ERS, HNIS, and NASS--which coordinate their efforts through regular interagency meetings. It includes uniform sample collection, commodity analysis, and a quality assurance system. FY 1993 funding levels allow the program to involve 9 States and 12 commodities. In 1992 at least 26 EPA pesticide residues are in the program. EPA will use the data in setting pesticide tolerance levels, while other Federal and State agencies will use it in determining policies intended to safeguard public health.

• DHHS National Health Objectives for the Year 2000

HNIS continues to conduct appraisals of the dietary status of Americans to determine progress in meeting the year 2000 Health Objectives. The Health Objectives in relation to the consumption of grain products, fruits and vegetables, and calcium-rich foods are the same as expressed in the Food Guide Pyramid developed by HNIS. Promotion of the Food Guide, which is intended to help consumers implement all the Dietary Guidelines, is an important focus of work. Consumers, on average, do not meet the objective of at least 5 servings of fruits and vegetables and 2-3 servings of calcium-rich foods per day.

• National Cholesterol Education Program

HNIS is USDA's liaison to the National Cholesterol Education Program (NCEP) Coordinating Committee. In this role, HNIS keeps the Committee informed of USDA research results from food consumption surveys regarding dietary status and activities that are supportive of the Dietary Guidelines for Americans.

- The Interagency Task Force for Native American Nutrition Education

FNS formed a task force of eight Federal agencies and two national Native American organizations to better coordinate Federal nutrition education to Native Americans. The identification of nutrition education needs specific to this population group and the efficient use of human and financial resources to effectively address these needs are goals of the task force. The inclusion of Native American groups helps ensure that these needs will be correctly identified, and that educational strategies developed will be sensitive to Native American cultural traditions. In FY 1992, the task force established specific objectives, and it has already improved the dissemination of information to Native American organizations serviced by member agencies on opportunities to enhance nutrition education by applying for grants and participating in studies. In FY 1993, the task force will establish the specific projects that will be pursued. The relatively high incidence of diet-related health problems among the Native American population underlines the exigency of this effort.

- 1988 National Maternal and Infant Health Survey

FNS is one of several Federal agencies participating in a health data collection effort by the National Center for Health Statistics. Major areas of investigation include low birthweight and infant mortality; barriers to and facilitators of prenatal care; the effects of substance use on pregnancy outcome; and use of public programs, such as WIC, by mothers and infants. The inclusion of WIC questions in the survey is expected to provide data on WIC services and outcomes in the context of other health and medical information covering most of the nutritional risk conditions for high-priority WIC eligibility during pregnancy. Information from the mothers' survey was released to FNS in September 1991. Provisional health care provider survey information was released to FNS in September 1992. Analysis of the mothers' data has been initiated and the 1991 longitudinal follow-up data have been collected.

- Healthy Children Ready To Learn

The first of the President's six national education goals States: "By the year 2000, all children in America will start school ready to learn." One of the objectives of this goal is to ensure that children will receive the nutrition and health care needed to arrive at school with healthy minds and bodies, and that the number of low birthweight babies will be significantly reduced through enhanced prenatal systems. The WIC Program can play a vital role in achieving this objective.

A major activity in support of achieving this goal was the Surgeon General's Healthy Children Ready to Learn: The Critical Role of Parents Conference, held in February 1992. More than 600 parents, professionals, educators, government officials, program directors, and organization representatives concerned with the health and education of young children participated in the conference. The Food and Nutrition Service, USDA, was a significant player in this conference, contributing both financial support and sponsoring several workshops. We have continued to work with the Surgeon General on actions to be taken as a result of recommendations made by parents at the conference, primarily improving access to health, educational, and social programs and reducing administrative burdens associated with the eligibility determination process.

- U.S. Department of Education's Even Start Program

Even Start is a family literacy program intended to improve the educational opportunities of the nation's children and adults by integrating early childhood education and adult education for parents into a unified program. Because Even Start, WIC, and the Commodity Supplemental Food Program (CSFP) target services to a similar population, the programs could serve as valuable outreach contacts for each other. Recognizing the common goals among WIC, CSFP, and the Even Start Program, the Department of Education and the Department of Agriculture developed a Memorandum of Understanding (MOU). The purpose of the MOU is to foster working relationships at the Federal, State, and local levels to provide and improve services to populations served by the three programs. The MOU is currently being reviewed by both departments.

- U.S. Department of Health and Human Services Head Start Program

In recognition of the need to encourage and practice information sharing, improve coordination, enhance communication, and foster outreach and referrals in order to better serve low-income parents and their children, a Memorandum of Understanding (MOU) has been developed between the Head Start Bureau, DHHS, and the FNS, USDA. Areas identified for potential coordination include sharing nutrition education materials; development of materials for Hispanic audiences; allowing the provision of nutrition education in Head Start to count toward the required contacts in the WIC Program; coordinating efforts to provide full access to immunizations for preschool-aged children served by Head Start and WIC; and coordinating services and referrals to avoid overlap and prevent gaps in service.

- Interagency Work Group for the President's Healthy Start Initiative

USDA, most notably WIC, continued its efforts in support of the Healthy Start initiative by providing technical assistance and guidance to the 15 grantees. As the grantees begin to implement their comprehensive plans, USDA will continue to provide assistance as requested.

• USDA/DHHS Nutrition Education Committee for Maternal and Child Nutrition Publications

This committee, established in 1980, meets three times a year. Its purpose is to promote a joint effort between the two departments on educational materials related to maternal and child nutrition in order to assure consistency of content, avoid duplication, and make more effective use of resources.

B. Coordination Within USDA

During 1992 extensive efforts were made to clarify the roles of all agencies in furthering the goals of human nutrition programs. The Assistant Secretaries of Science and Education and Food and Consumer Services convened ad hoc working groups to review the coordination structure. The working groups were drawn from the USDA subcommittee for human nutrition. They made a recommendation to the Deputy Secretary to change the structure that had been in place for the Task Force on Nutrition Education and the Subcommittee on Human Nutrition. The recommended structure is to have (1) a Human Nutrition Policy Committee that reports to the Secretary through the Secretary's Policy Coordination Council and (2) a Human Nutrition Coordinating Committee that reports to the Policy Committee.

• Dietary Guidance Working Group

The Dietary Guidance Working Group of the Human Nutrition Coordinating Committee, initiated in 1986, continues to review all USDA draft publications and materials that contain dietary guidance for the general population and to coordinate review of those materials with the Department of Health and Human Services (DHHS). In accordance with the National Nutrition Monitoring and Related Research Act of 1990, the Group now also reviews dietary guidance materials produced by DHHS. The purpose of the review is to ensure that dietary guidance from the Federal Government accurately reflects Federal nutrition policy as expressed in the Dietary Guidelines for Americans and to ensure that guidance is supported by valid scientific or medical knowledge. About 25 materials were reviewed during FY 1992. A Memorandum of Understanding between USDA and DHHS to formalize the review process is under discussion. USDA's group is chaired by HNIS and includes representatives from 10 USDA agencies--AMS, ARS, CSRS, ERS, ES, FNIC, FNS, FSIS, HNIS, and OPA--and a liaison from DHHS. The group also serves as a means of communication among nutrition education specialists in these agencies.

• USDA Task Force on Nutrition Education

Better nutrition through nutrition education--with an emphasis on children and low-income adults--is one of USDA's four strategic goals. A departmentwide task force co-chaired by the Assistant Secretary for Food and Consumer Services and the Assistant Secretary for Science and Education prepared reports for improving coordination and evaluation of nutrition education efforts.

• CES/ES/HNIS Cooperation on Nutrition Education Information Needs

Through a Memorandum of Understanding initiated in 1987, ES and HNIS are working together to achieve their common goals in nutrition education. A Cooperative Extension System/ES/HNIS consulting group meets about three times a year through teleconferences and once a year in person to share information concerning Federal activities and priority nutrition education issues at State and local levels.

• Cooperation on Research Related to Federal Food Assistance Programs

HNIS formed a working group to review the methodology used in the development of the Thrifty Food Plan (TFP), which is used to set the cost allotments for the Food Stamp Program. In addition to HNIS which is responsible for the TFP, FNS, ERS, and ARS are represented on the working group.

• HNIS and ERS Cooperation on Food Supply Data

HNIS and ERS cooperate in publishing information on the U.S. food supply. ERS produces data on amounts of foods consumed, and HNIS uses those data to generate estimates of the nutrient content of the food supply. In accordance with the 10-Year Plan for Nutrition Monitoring, HNIS and ERS are cooperating on finding ways to increase use and understanding of the food supply data.

• USDA Task Force on Nutrition Education

Better nutrition through nutrition education--with an emphasis on children and low-income adults--is one of USDA's four strategic goals. To lead this effort, a department-wide task force was established to unify, coordinate, and enhance USDA's nutrition education activities. The task force is co-chaired by the Assistant Secretary for Food and Consumer Services and the Assistant Secretary for Science and Education.

• Cooperative Regional Research Projects

CSRS administers Hatch and Evans-Allen funds to support cooperative human nutrition research involving land-grant institutions and the 1890 colleges and universities. These projects are regional and may involve ARS, ERS, and HNIS scientists. The active regional projects in human nutrition are listed and specific objectives described.

- Western Regional Research Project (W-143) --Nutrient Bioavailability--a Key to Human Nutrition

Our understanding of the dietary factors that affect the digestion and absorption of available forms of nutrients, especially vitamins and minerals, is limited. Because some of the nutrients (iron, calcium, pyridoxine, folacin) most affected appear to be marginal or low in diets of certain population subgroups, data on bioavailability becomes of critical importance in establishing sound dietary requirements as well as in appraising dietary adequacy. The project's objectives are to (1) determine the bioavailability of vitamins and minerals in plant- and animal derived foods in human subjects and (2) develop methods for determining bioavailability of dietary factors in vitro and in animal models for predicting human bioavailability. This project was renewed in October 1992 and involves 13 universities, the ARS Western Human Nutrition Research Center, and 2 representatives from industry.

- North Central Regional Research Project (NC-167)--Health Maintenance Aspects of Dietary Recommendations Designed To Modify Lipid Metabolism

The objectives of this project were revised in October 1992 to (1) determine the effects of changes in the quantities and ratios of dietary fatty acids on physiological factors influencing health maintenance; (2) determine the impact of diets which meet the Dietary Guidelines, especially with regard to fat and fiber content, on aspects of lipid, lipoprotein, and energy metabolism that influence health maintenance; and (3) assess the impact of diets which meet the Dietary Guidelines on minerals and electrolytes that affect lipid metabolism and health maintenance. This study involves collaboration among 16 universities and two ARS centers.

- Northeast Regional Research Project (NE-172) --Nutritional Assessment of Older Adults: Diet Intake and Biochemical Studies

The objectives of this regional project are to (1) assess the validity of methods of determining food intake and study factors affecting food intake in older adults; (2) evaluate biochemical methods for measuring iron, magnesium, protein, and amino acid status of older adults; and (3) compare and integrate biological, cultural, and sociological measurements as indices of nutritional status in the elderly. This project involves researchers from nine States, ARS, and HNIS.

- North Central Regional Research Project (NC-200) --Behavioral and Health Factors That Influence the Food Consumption of Young Adults

The objectives of this project are to (1) identify traits, behaviors, concerns, and perceptions that influence the food consumption decisions of young adults and (2) determine the influence of cultural, behavioral, and perceptual factors, and their interactions, on the diet of young adults. This project involves collaboration among scientists from eight universities plus HNIS.

- Western Regional Research Project (W-182) --Dietary Fat and Fiber: Knowledge, Perceived Risks, and Dietary Practices

Five objectives are addressed in this project: (1) to determine respondents' knowledge and understanding of the dietary guidelines for fat and fiber; (2) to determine the degree to which respondents are following the recommended guidelines; (3) to examine respondents' perception of health risks associated with intake of fat and dietary fiber; (4) to identify constraints to and motivating factors for following these guidelines in relation to population characteristics; and (5) to determine differences between respondents in the general population and those medically defined at risk with respect to knowledge and understanding of the dietary guidelines for fat and fiber, perception of associated health risks, and compliance with dietary recommendations. Twelve universities plus HNIS are involved.

- Southern Regional Research Project (S-216)--Changing Patterns of Food Demand and Consumption Behavior

The objectives of this project were expanded in October 1992, to (1) develop and evaluate data bases for understanding food demand and consumption behavior; (2) estimate food demand parameters with alternative theoretical and applied models; (3) measure, assess, and interpret changing patterns of food demand and consumption behavior for analyses of food policies, food programs, consumer protection (e.g., food safety), and consumer education; and (4) identify and assess changing patterns of food demand and consumption behavior in selected countries for improved understanding of food demand in U.S. export markets. This project involves about 23 university agricultural economics departments, Agriculture Canada, the Bureau of Labor Statistics, ERS, and HNIS.

- 1890 Regional Research Project (RR-6)--Evaluation of Effective Intervention Methods to Improve the Quality of Well-Being of Rural Elders

Most departments of human ecology within the 1890 university system are participating in this multi-disciplinary project. One specific objective addresses the effectiveness of dietary management programs on nutritional practices and diet behavior of older persons.

C. Coordination with the Private Sector and International Organizations

- Breastfeeding Promotion Consortium

USDA hosts ongoing semi-annual meetings of the Breastfeeding Promotion Consortium to exchange information on how government and private health interests, including major professional health organizations, can work together to promote breastfeeding and to explore and implement joint efforts. Over 25 organizations participate in the Consortium, including DHHS, the American Academy of Pediatrics, the American Nurses Association and the Healthy Mothers, Healthy Babies Coalition. The Consortium meets semi-annually in Washington, D.C., and was convened in June 1990, February and August 1991, and March 1992. At the Consortium's recommendation, the Department has developed plans for a national campaign to promote the concept that breastfeeding is the optimum choice for infant feeding for both mother and baby. Public Law 102-342, enacted August 1992, requires USDA to develop such a campaign and authorizes the Department to finance it with donations from outside sources.

- Baby-Friendly Hospital Initiative

USDA is involved with the Baby-Friendly Hospital Initiative, jointly sponsored by the United Nations Children's Fund (UNICEF) and the World Health Organization, to encourage hospitals in countries around the world to provide optimal breastfeeding promotion and support services by implementing
10 essential steps. USDA is actively coordinating with UNICEF, DHHS, and various non-governmental groups to implement this initiative in the United States.

- The Nutrition Education Task Force

This task force was established in 1985, as a continuation of the Sodium Education Task Force, to focus on broader issues in nutrition and food safety. The task force meets several times a year to share resources and information. Members include Federal agencies such as USDA's HNIS and FSIS, DHHS's National Heart Lung and Blood Institute, the National Cancer Institute, and FDA; industry groups such as the International Food Information Council, the Food Marketing Institute, the National Food Processor's Association, the Grocery Manufacturer's Association, and the National Restaurant Association; and consumer groups such as the Center for Science in the Public Interest and Public Voice.

- Food Supply Information

ERS and HNIS cooperate with many commodity trade organizations, industry groups, and university experiment stations in the process of collecting and analyzing food production and consumption data. In addition, many procedural changes instituted by ERS and HNIS are submitted to such expert groups for comment prior to institution.

ERS and HNIS also provide the Organization for Economic Cooperation and Development with U.S. data concerning the food supply.

D. Advisory Groups

1. Human Nutrition Board of Scientific Counselors (HNBSC)

The duties of the HNBSC are to review the human nutrition research and education activities within USDA and advise the Secretary of Agriculture on policy and program matters relating to human nutrition research and education. At its meeting in March 1992, the board developed and adopted the following eight resolutions:

Resolution 1. Concerning Structure and Conduct of Human Nutrition Board of Scientific Counselors Activities

Resolved that organizational changes to improve the Board's advisory function be implemented. These changes to include (1) semiannual meetings of the Board; (2) naming of Co-chairs of the Board, i.e., the Assistant Secretary for Science and Education as Chair and a Vice-chair to be recommended by the Board; and
(3) appointment of a small executive committee to be made up of the Chair, Vice-chair, Executive Secretary and three additional members of the Board who shall be responsible for meeting agendas and other organizational details including naming appropriate subcommittees to review substantive activities related to the charge of the committees, e.g., nutrition education, research, and monitoring.

Resolution 2. Relating to the Prioritization of Nutrition-Related Activities Within the Department

Resolved that the broad experience and backgrounds of the members of the Board be utilized to review and advise on the priorities among human nutrition activities within the Department.

Resolution 3. Concerning Recommendations Made by Board's Working Group on Nutrition Monitoring

Resolved that the Department: (1) undertake a comprehensive review and prioritization of the uses and applications of food consumption and related surveys current and for the next decade that build on and extend the nutrition monitoring review that was conducted by the National Academy of Sciences;
(2) establish a technical advisory work group composed of external experts as an initial attempt to incorporate the multiple user needs within the mandate of conducting and maintaining a general-purpose survey; (3) explore participatory roles of appropriate internal USDA agencies (e.g., Extension Service) to utilize their expertise and resources in conducting future surveys; (4) enhance the number and expertise of the survey staff commensurate with the priorities and uses of food consumption and related surveys as determined by items 1 and 2; and (5) develop complementary intramural and competitive extramural research programs in the area of survey instruments for the assessment of food consumption and related behaviors, especially in specified targeted groups.

Resolution 4. Concerning the Report of the Board's Working Group on Nutrition Education

Resolved that the October 2, 1991, report of the Ad Hoc Committee to Review Evaluation Processes for USDA Nutrition Programs and Materials is to be forwarded to Dr. Harry Mussman, Interim Assistant Secretary for Science and Education, with the request that the report be distributed as deemed appropriate and used to improve nutrition programming in the Department.

Resolution 5. Concerning Use of Board's Expertise in Addressing Critical Issues in Nutrition Within USDA

Resolved that the Department involve the Board at an early date to review plans for such major initiatives so that the Board can provide meaningful guidance and support for the Department's substantive activities in the public arena.

Resolution 6. Concerning the USDA Nutrition Education Initiative

Resolved that the Board have an advisory role in planning and evaluating the Nutrition Education Initiative which can be facilitated by a subcommittee of the Board.

Further resolved that the following groups be considered for participation in the Policy Advisory Committee of the Nutrition Education Initiative:

- Professional Societies
- Trade and Scientific Associations
- Commodity Groups

Further resolved that an external technical review committee be appointed to evaluate and make recommendations about the content of the Nutrition Education Initiative.

Resolution 7. Relating to the Condition of Facilities at the Beltsville Human Nutrition Center

Resolved that the Board continue to support efforts to upgrade this facility.

Resolution 8. Concerning the Future of the Western Human Nutrition Research Center

The Board reaffirms its resolution of concern for the future space needs of the Western Human Nutrition Research Center. If WHNRC is not allowed to continue to be housed at the Letterman Army Institute for Research, Presidio, San Francisco, California, the Board urges that every effort be made to locate the Center at one of the University of California campuses.

2. National Advisory Council on Maternal, Infant, and Fetal Nutrition

The National Advisory Council on Maternal, Infant, and Fetal Nutrition met on September 16-18, 1992, to deliberate issues relevant to the Special Supplemental Food Program for Women, Infants, and Children (WIC) and the Commodity Supplemental Food Programs (CSFP). These issues included the adequacy of Federal funding support for nutrition and health education, coordination, and referral services; increasing vendor management incentives; the feasibility of changing food packages to accommodate cultural preferences; and improving client services. The Council will meet in October 1993 to develop its 1994 biennial report to Congress recommending ways to improve the administration of both WIC and CSFP.

3. National Nutrition Monitoring Advisory Council

The National Nutrition Monitoring Advisory Council was established by an Executive Order of the President of the United States in 1991, pursuant to P.L. 101-445. The 9-member Council provides scientific and technical advice on the development and implementation of the coordinated program and comprehensive plan for the National Nutrition Monitoring and Related Research Program. The Council serves in an advisory capacity to the Secretaries of USDA and DHHS. The Council met February 26-27, July 15-16, and September 24-25, 1992,
in Washington, D.C., during this first year of operation, the Council received orientation and updates on the current activities in nutrition monitoring and defined six major areas of focus. In its first annual report to the Secretaries of USDA and DHHS in December 1992, the National Nutrition Monitoring Advisory Council recommended, among other things, that a process for deciding the overriding

priorities for the program across agencies throughout the Government be implemented.

- Nutrient Data Bank Consultant Panel

In HNIS, Nutrition Monitoring Division, Nutrient Data Research Branch (NDRB) Consultant Panel was established to address issues and make recommendations to NDRB related to food composition. The three member panel has one member representing industry, one from academia, and a U.S. Government member. The members' qualifications cover the areas of analytical methods, data bank building, and data base management. The Panel met in June 1992 and will continue to meet annually.

VI. Benefits

The USDA Human Nutrition Research and Education Program, described in its 1986 report to Congress, required the determination of nutrient needs and food sources of these nutrients, the monitoring of food consumption practices and the nutritional qualities of diets, and the development of information techniques to foster the selection of healthful diets by Americans. In pursuing this course, the program has embodied problem-oriented research coupled with research-based nutrition education of professionals, producers, and the public. Sound nutrition education efforts have led to changes in consumer demand, which, in turn, have provided industry with the opportunity to market modified and nutritionally improved food products.

Scientific investigations, such as those reported here, have clearly shown that what we eat can affect our health. In fact, most authorities agree that our diets can affect the risk related to 5 of the 10 leading causes of death in the United States, including coronary heart disease, stroke, atherosclerosis, diabetes, and some types of cancer. Obesity is also due to an imbalance between energy intake and expenditure. In addition, several other problems, such as dental caries, bone strength, physical and mental performance, and immune response, can be influenced by nutrition.

Benefits of improved diets and better nutrition are improved health and a longer, more active, and satisfying life. The development of new food and nutrition knowledge as well as the application of existing knowledge are essential to the alleviation of diet-related health problems. The USDA, through its many nutrition research and education activities, is developing information to fill in knowledge gaps and helping to apply the knowledge important to the alleviation of diet-related health problems and for better performance and well-being of Americans.

New food and nutrition knowledge from USDA research benefits the public and the many segments of the population who produce and market food and who educate and provide health services to the public. New information is constantly required by policymakers who formulate food assistance, public health, and education programs. Nutrition knowledge forms the information base for dietary guidance for the public.

The USDA Food and Nutrition Program has contributed to development of up-to-date analytical data on the nutrient composition of foods in the forms that people use to meet their nutritional needs. Once the long-range program objectives have been achieved, even more reliable information will be readily available to determine the kinds and amounts of nutrients in foods and diets. The technology is available to improve the nutritional value of many foods. Industry has also improved guidelines on changes in nutrient content of foods arising from processing, so that products might be improved where indicated. New regulations for nutrient labeling of food were established in 1992 to enable the public to better manage its food choices.

Advances in technology have made it possible to minimize nutritional inadequacies of most diets or diet patterns. Consumers benefit from knowledge of the nutritional usefulness of foods and can be assured of better nutrition where some foods have been improved. Health professionals, nutrition educators, food program directors, and the foodservice industry benefit from additional knowledge about nutrition. The USDA agencies involved in supplemental feeding have developed an improved scientific basis for food selection in their food distribution or food programs aimed at improving nutritional health.

For the consumer, better health may be enjoyed through improved nutrition resulting from diets providing the right amount and types of nutrients. People are better able to achieve their full potential, including resistance to disease, intellectual development, and physiological well-being. These can be significant consequences of improved nutrition.

The potential economic benefits from improvement of human nutrition that result from research findings about food needs include significant reduction of health care costs for heart and vascular problems, reduced hospital costs in connection with respiratory and infectious diseases, reduced costs associated with arthritis, savings from lower expenditures for dental services, savings for people with eyesight problems, and significant reduction of health care costs for digestive problems and losses associated with alcoholism. Additional problems where improved nutrition can have tangible benefits include anemia, mental illness, infant mortality, debility of aging, diabetes, osteoporosis, obesity, kidney and urinary problems, and certain cancers. There can also be increased economic benefits for different segments of the population, through increased work efficiency, an increase in the productive lifespan, and reduction in the number of days lost from work and school.

Considerable progress has been made, but many knowledge gaps remain. Undoubtedly, benefits can be expected to be derived from improved nutritional progress that will result during the next decade. Some of these may be because society is able to improve health care, food producers or processors are able to improve the nutritive value of food products, educators are able to guide families into improved dietary practices, or Government agencies are able to deliver better nutritional services in the administration of food programs for the needy or those at risk.

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